PROSPECTIVE STUDY OF EFFECT OF PROPHYLACTIC RETENTION SUTURES IN MIDLINE LAPAROTOMY IN HIGH RISK PATIENTS FOR PREVENTION OF WOUND DEHISCENCE IN GOVERNMENT RAJAJI HOSPITAL, MADURAI

DISSERTATION SUBMITTED FOR

MASTER OF SURGERY

BRANCH - I (GENERAL SURGERY)

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CHENNAI

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **PROSPECTIVE STUDY OF "EFFECT OF PROPHYLACTIC RETENTION SUTURES IN MIDLINE LAPAROTOMY IN HIGH-RISK PATIENTS FOR PREVENTION OF WOUND DEHISCENCE" IN GOVERNMENT RAJAJI HOSPITAL, MADURAI** submitted by **Dr.Ram Praveen .P** to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of M.S. Degree Branch I (General Surgery) is a bonafide research work was carried out by him under my direct supervision & guidance.

Dr. S.R.DAMODHARAN, M.S,
Professor of General Surgery,
Department of General Surgery,
Madurai Medical College,
Madurai.

Dr. S.R.DAMODHARAN, M.S
Professor& Head of the Department,
Department of General Surgery,
Madurai Medical College,
Madurai.

CERTIFICATE BY THE DEAN

This is to certify that the dissertation entitled **PROSPECTIVE STUDY OF EFFECT OF PROPHYLACTIC RETENTION SUTURES IN MIDLINE LAPAROTOMY IN HIGH-RISK PATIENTS FOR PREVENTION OF WOUND DEHISCENCE IN GOVERNMENT RAJAJI HOSPITAL, MADURAI** is a bonafide research work done by **Dr.RAM PRAVEEN .P,** Post Graduate Student, Department of General Surgery, MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI, under the guidance and supervision of **Dr.S.R.DAMODHARAN, M.S,** Professor Department of General Surgery,MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI.

DATE: **Prof.Dr.D.MARUTHUPANDIAN M.S.,**

PLACE: Madurai **DEAN**

MADURAI MEDICAL COLLEGE

DECLARATION

I, **Dr.Ram Praveen.P** declare that, I carried out this work on, "**PROSPECTIVE STUDY OF EFFECT OF PROPHYLACTIC RETENTION SUTURES IN MIDLINE LAPAROTOMY IN HIGH-RISK PATIENTS FOR PREVENTION OF WOUND DEHISCENCE IN GOVERNMENT RAJAJI HOSPITAL, MADURAI**" At the Department of General Surgery, Govt. Rajaji Hospital during the period of **August 2017 to August 2018**. I also declare that this bonafide work or a part of this work was not submitted by me or any others for any award, degree, diploma to any other University, Board either in India or abroad. This is submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulations for the M.S. degree examination in General Surgery.

Place: Madurai

Date: **Dr.RAM PRAVEEN .P**

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Dr.RAM PRAVEEN.P

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INTRODUCTION

The occurrence of sudden disruption of the abdominal laparotomy wound is a major disaster in the life of a patient who has undergone an abdominal operation and a major psychological blow to the patient as well as the surgeon. The partial or complete postoperative separation of abdominal wound closure is known as wound dehiscence or acute wound failure. Acute wound failure is defined as postoperative separation of the abdominal musculoaponeurotic layers, within 30 days after operation and requires some form of intervention, usually during the same hospitalization. Most Wound dehiscence occur between the 6^{th} and 9^{th} postoperative day.

The integrity of the sutured abdominal wound depends on a balance between the suture holding capacity of tissues and tissue holding capacity of sutures. Numerous clinical trials have compared layered to mass abdominal closure. Some studies have shown an increased incidence of wound dehiscence and incisional hernia with layered closure, and some studies show no difference in these complications, but no studies have shown an advantage of layered over mass closure. With recent advances in suture material and the use of mass closure technique the rate of dehiscence has generally been less than 1%, The prevalence of

wound dehiscence in Indian scenario is found to range from 10-30% for emergency cases and 0-5% for elective cases.

REVIEW OF LITERATURE

It has been shown experimentally by Jenkins that the length of a midline laparotomy incision can increase up to 30% in the postoperative period in association with several factors that increase the intra-abdominal pressure and determined that a suture length-to-wound length ratio should be 4:1. A meta analysis on 23 randomized trials showed that odds of wound dehiscence was reduced to half with interrupted method of closure compared to continuous method.

In emergency surgery, interrupted sutures are better than continuous method as they have “gigli saw” or “hack saw” effect. Various types of interrupted sutures are described. They are Smead-Jones far and near technique, figure of eight, Huges technique of double far and near horizontal mattress and the latest interrupted X suture by Srivastava A et al.

Bucknall et al prospectively studied 1129 abdominal operations and demonstrated that layered closure was associated with a significantly higher dehiscence rate compared with mass closure (3.81% vs. 0.76%). Similarly other studies have also shown that mass closure have low incidence of both wound dehiscence and incisional hernia.

In Asian countries the incidence of abdominal wound dehiscence is still very high and stays above the 10% level due to various factors which include the following

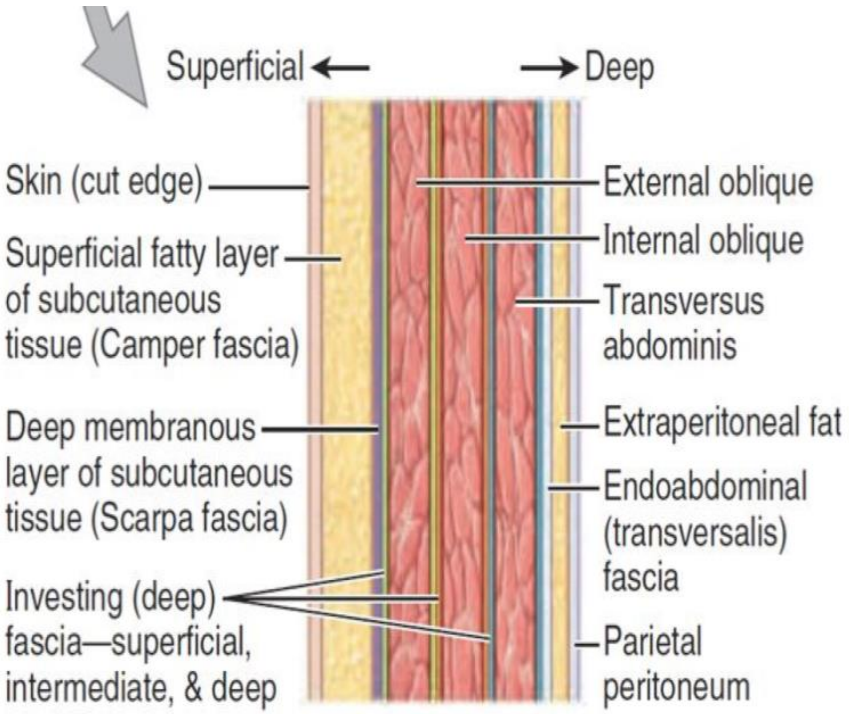
- widely prevalent malnutrition
- Lack of proper health care delivery system providing emergency surgical treatment.
- The operation at the rural and suburban level may be often delayed for a day or more resulting in much tissue necrosis of the linea alba
- More marked systemic inflammatory response syndrome adversely affecting healing and collagen synthesis.

ANATOMY

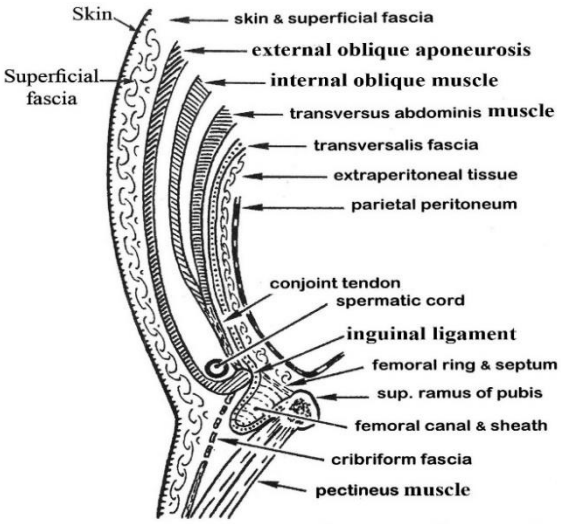
ANTERIOR ABDOMINAL WALL

It is formed of the following layers:

1. Skin
2. Superficial fascia (no deep fascia).
3. Abdominal muscles
4. Fascia transversalis
5. Extraperitoneal fat.
6. Parietal peritoneum.



(B) Longitudinal section



Layers of the anterior abdominal wall
(Longitudinal section at the level of femoral sheath)

SKIN:

It is thin & presents the **umbilicus** which is inverted scar formed by separation of umbilical stump after birth. Umblicus usually lies in the linea alba at different level for different individual. Usually it is located one finger below a point midway between the xiphoid process & symphysis pubis (disc between $L_{3\&4}$). Its level is one of the sites of anastomosis between superior vena cava and inferior vena cava and porto-systemic anastomosis.

It is inverted because its posterior surface of the umbilicus is the meeting of falciform ligament , ligamentum teres of liver (obliterated left umbilical vein), right & left medial umbilical ligaments (obliterated umbilical arteries) & median umbilical ligament (obliterated urachus). Above the level of umbilicus the lymphatic & venous drainage to the axilla while below this level they pass downwards to the groin.

Nerve supply:

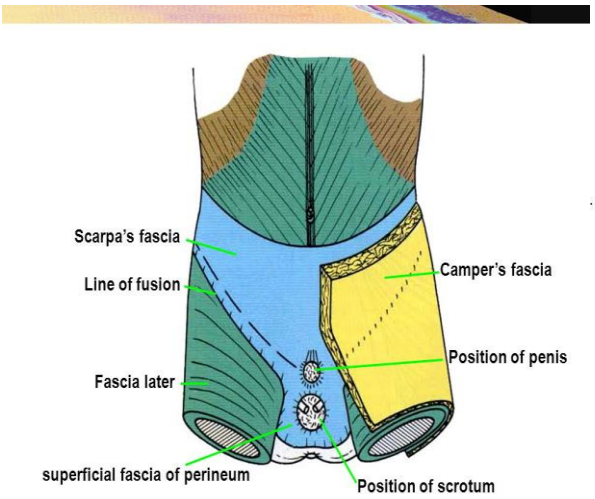
Skin of anterior abdominal wall is supplied by $T_{7\text{-}12}$ & L_1 nerves . Skin of at level of umbilicus is supplied by T_{I0}

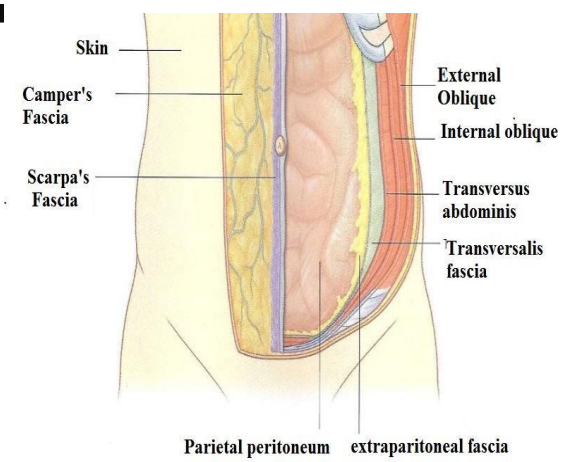
SUPERFICIAL FASCIA

It differentiates, particularly below the umbilicus, into 2 layers:

a) **Superficial fatty layer: (Camper's fascia)** which is a major site for storage of fat .

b) **Deep membranous layer**: **(Scarpa's fascia)** developed below the umbilicus. It is attached to the fascia lata of thigh a finger breadth below the inguinal ligament. In the median plane , it envelopes the penis & scrotum then extends backwards into the perineum as Colle's Fascia which is attached to the posterior border of perineal membrane → superficial perineal pouch which contain bulbar urethra → ***in extra-pelvic rupture of male urethra, extravasation of urine into the perineum, scrotum, penis and anterior abdominal wall (between Scarpa's fascia & abdominal muscles).***





MUSCLES OF ANTERIOR ABDOMINAL WALL

INSERTION:

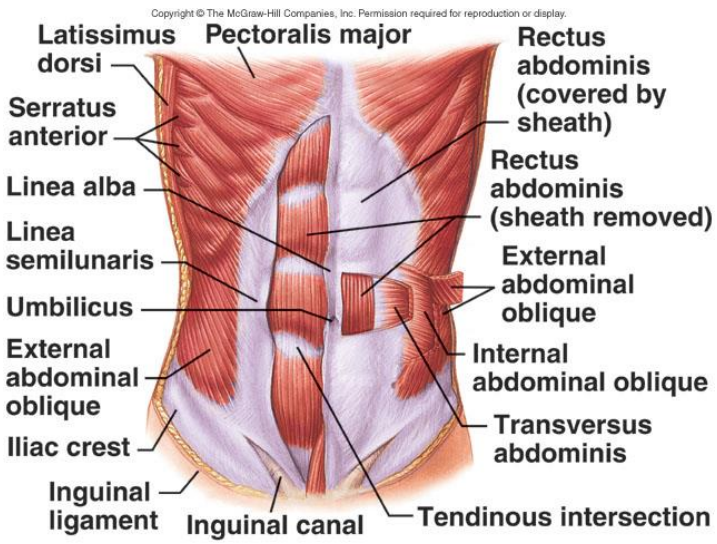
The lateral 3 muscles develop 3 broad aponeuroses towards the median plane to form the rectus sheath, then become inserted in the linea alba

NERVE SUPPLY:

- Lower 5 intercostal,
- subcostal ,
- iliohypogastric
- ilioinguinal nerves .

ACTION :

- Respiration,
- protect viscera,
- keep viscera in position during increase intra-abdominal pressure ,
- flex trunk(rectus) &lateral flex and twist trunk.



MUSCLE	ORIGIN	INSERTION	IMPORTANT FEATURES
External Abdominal Oblique	• Outer Surface of Lower 8 ribs	• Xiphoid process, linea alba& symphysis pubis • A.S.I.S, outer lip of iliac crest. • Pubic tubercle	1) Its fibers runs downwards, forwards & medially. 2) The Lower part of aponeurosis of ext. oblique form the main part of inguinal lig. 3) The ext. inguinal ring is an opening in the aponeurosis of ext. oblique m. 4) The aponeurosis is prolonged at the ext. ring to form the ext. spermatic fascia. 5) Below a line between A.S.I.S. & umbilicus, the muscle becomes aponeurotic.
Internal Abdominal Oblique	• Lat. 2/3 of upper concave surface of inguinal ligament . • Intermediate part of iliac crest. • Thoracolumbar fascia	• Lower 6 costal cartilages. • Xiphoid process & linea alba& symphysis pubis . • Lower fibers (conjoint tendon) is inserted into pubic crest & medial part of pectineal line.	• The fibers runs upwards, forefwards & medially. • Cremastric m. is derived from int. oblique. It form U shaped loop around the spermatic cord & testis inserted into pubic tubercle. It elevate the testis during coughing, straining & ejaculation. • The lower fibers of int. oblique has a triple relation to the spermatic cord: 1) first ant. to the cord forming the lat. 1/2 of ant. wall of inguinal canal. 2) Arch above the cord forming the roof of inguinal canal. 3) Finally, the conjoint tendon lies behind the cord forming the med. 1/2 of post. wall of inguinal canal.

Transversus abdominis	• Lat 1/3 of the upper surface of inguinal ligament. • Inner lip of iliac crest. • Thoracolumbar fascia. • Inner surface of lower 6 coastal cartilages	• Xiphoid process & linea alba& symphysis pubis . • Lower fibers (conjoint tendon) is inserted into the pubic crest & medial part of pectineal line.	1- The fibres runs transversely. 2- It is lined by transversalis fascia. <u>3- Conjoint tendon:</u> •It is the fused lower parts of aponeurosis of int. oblique & transversus abdominis near their insertion. • It passes in the med. 1/2 post wall of inguinal canal . • The fibres of trasversus abdominis arches at a higher level than int. oblique (no role in formation of ingunal canal. • The conjoint tendon is supplied by ilioinguinal nerve.
Rectus abdominis	• Pubic crest & front of symphysis pubis	• along a horizontal line into xiphoid process & outer surface of 5,6,7 coastal cartilage.	1- The lat. border of rectus abdominis is called linea semilunaris. 2- It has 3-4 tendinous intersection (at xiphoid process, umbilicus, midway bet. the above 2 & one below the umbilicus).
Pyramidalis	• Pubic crest & front of symphysis pubis.	• Lower inch of linea alba	It is anatomical landmark to midline in supra-pubic incision.

LINEA ALBA:

It is a strong raphe situated in the middle line of anterior abdominal wall between the 2 rectus abdominis muscle. It is formed by interdigitting fibers of the 3 aponeuroses of the muscles of anterior abdominal wall (after forming the rectus sheath). It is attached between xiphoid process & symphysis pubis.

Above the umbilicus,linea alba is wide approximately 1cm.Normally, contraction of 2 rectus muscle will obliterate this wide linea alba.

Below the umbilicus, it is a narrow line which can be identified by the insertion of pyramidalis muscles. It shows the umbilical scar.

RECTUS SHEATH:

It is a fibrous sheath formed by the aponeuroses of the muscles of anterior abdominal wall.

Formation:

1. ***Above the costal margin:***

   Anterior wall: Aponeurosis of external abdominal oblique.

   Posterior wall: Is deficient, the rectus muscle lies on 5, 6, 7 costal cartilages.

2. ***From the costal margin to a point midway between umbilicus and symphysis pubis:***

   Anterior wall: External oblique aponeurosis & anterior lamina of internal oblique aponeurosis.

   Posterior wall: Posterior lamina of internal oblique aponeurosis & aponeurosis of transversus abdominis**.**

3. ***Below a point midway between umbilicus & symphysis pubis:***

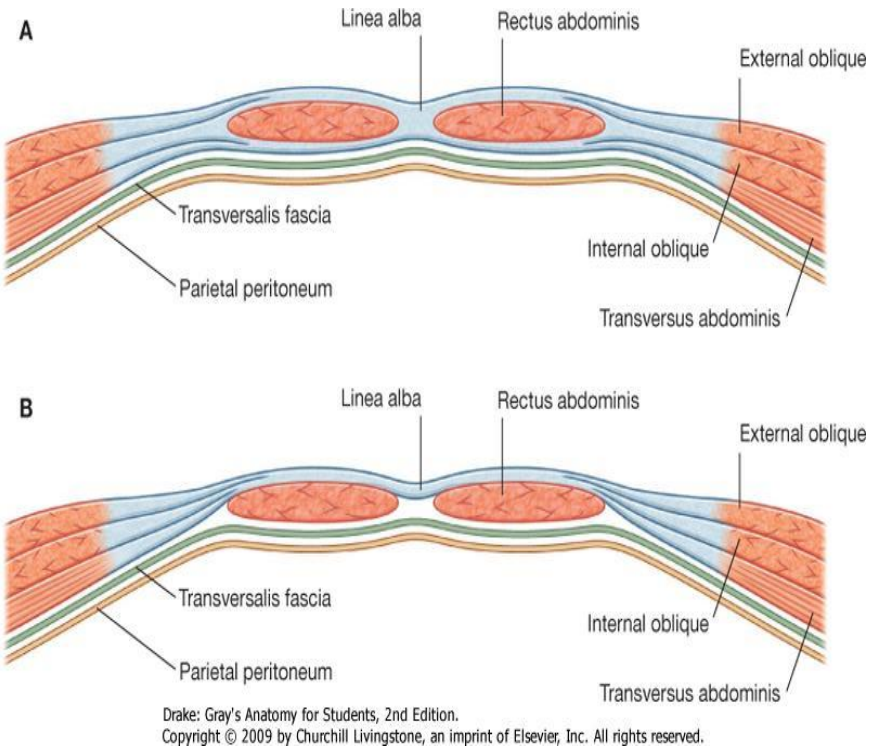
   Anterior wall: Aponeurosis of 3 muscles of anterior abdominal wall.

   Posterior wall: Is deficient, the rectus muscle lies on the transversalis fascia. The posterior wall of rectus sheath ends by forming arched border

called ***arcuate line***.

Contents:

- Rectus abdominis ,
- pyramidalis,
- superior & inferior epigastric vessels,
- lower 5 intercostal & subcostal nerve & vessels (pass from lateral to medial
- lymph vessels.



FASCIA TRANSVERSALIS

It is a thin fascia which lines the antero-lateral abdominal wall.

- **Above:** It is continuous with the fascia of diaphragm.
- **Posterior**: It enters in the formation of perirenal fascia (Zukercandle fascia)
- **Inferior:**
  - ***a) Medial :*** It is attached to pubic crest & medial part pectineal line.
  - ***b) Lateral:*** It is attached to inner lip of iliac crest & lat. 1/2 of inguinal ligament.
  - ***c) Between a & b*** is passed in the thigh to form the ant. wall of femoral sheath.

- **Deep inguinal ring** is an opening in the transversalis fascia. At the deep inguinal ring, the fascia transversalis prolonges around the spermatic cord as internal spermatic fascia.

Arteries of Anterior Abdominal Wall

A) Above the umbilicus:

1. **Two Terminal branches of the internal thoracic artery:**

   a) **Superior epigastric artery:**

      It runs down behind the 7th costal cartilage and enters the rectus sheath to run down behind the rectus abdominis muscle upto the level of the umbilicus and gets anastomosed with inferior epigstric artery.

   b) **Musculo-phrenic artery:**

      It runs downwards and laterally along the costal margin.

2. **Lower 5 (7-11) posterior intercostal arteries** and the subcostal artery (branches of the descending thoracic aorta)

   They run downwards and medially through the ***neuro-vascular plane*** between the internal oblique and the transversus abdominis to enter the rectus sheath behind the rectus abdominis from lateral to medial.

B) Below the umbilicus:

1. Superficial branches of the femoral artery:

a) Superficial epigastric artery.

b) Superficial circumflex iliac artery.

2. Branches of the external iliac artery:

a)Inferior epigastric artery:

Originates from external iliac artery just behind the inguinal ligament. It runs upwards and medially, ***medial to the internal inguinal ring ,*** runs in front of the arcuate line to enter the **rectus sheath** behind the rectus abdominis. Ends at the level of the umbilicus by anastomosing with superior epigastric artery.

Branches:

1) ***Cremasteric artery:***

It **enters** the deep inguinal ring as one of the contents of the spermatic cord to supply the cremasteric muscle and ends by anastomosing with the testicular artery.

2) ***Pubic branch:***

It runs down behind the lacunar ligament and superior pubic ramus to anastomose with the pubic branch of obturator artery. In 30% of cases, the obturator artery is

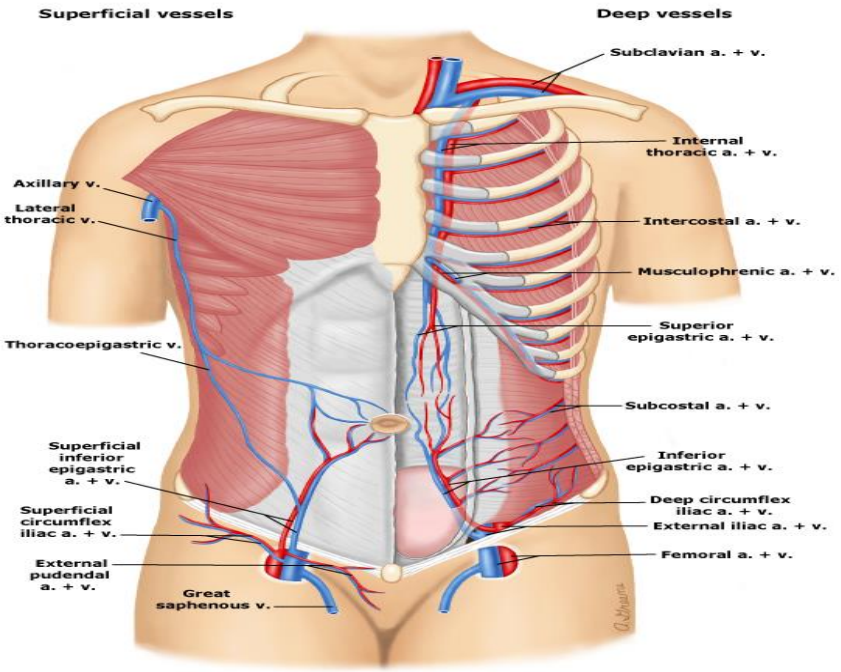
absent and replaced by **abnormal obturator artery** a large pubic branch of **inferior epigastric artery**. This artery passes behind the free sharp border of the lacunar ligament and ***is more prone for injury during operation for femoral hernia.***

b) Deep circumflex iliac artery:

Originates from **external iliac** artery just behind the inguinal ligament and passes upwards and laterally behind the inguinal ligament to reach anterior superior iliac spine. Then **runs** on the inner lip of iliac crest where it pierces the transversus abdominis to runs in the **neurovascular plane**.

Branches:

1) **Muscular branches**
2) **Anastomatic branches** sharing in the anastomosis around anterior superior iliac spine.
3) **Ascending branch:** ascends to anastomose with the lumbar and musculophrenic arteries.



Arterial anastomosis in the anterior abdominal wall:

1) ***Lateral anastomosis:*** between the ascending branch of deep circumflex iliac, lumbar and musclophrenic arteries.
2) ***Medial anastomosis:*** between the superior and inferior epigastric arteries.

Applied anatomy:

This anastomosis is very important to establish collateral circulation after obstruction of common or external iliac arteries.

VEINS OF ANTERIOR ABDOMINAL WALL

A) Above the level of the umbilicus:

1) ***Superior epigastric vein:*** runs in the rectus sheath deep to the rectus muscle to end in the internal thoracic vein (a tributary of brachiocephalic vein).

2) ***Lateral thoracic vein:*** runs in the superficial fascia on the lateral side of abdomen and thorax to end in the axillary vein.

B) Below the level of the umbilicus:

1) ***Inferior epigastric vein:*** runs in the rectus sheath deep to the rectus muscle to end in the external iliac vein.
2) ***Superficial epigastric and superficial circumflex iliac veins:*** run in the superficial fascia of the lower part of the abdomen to end in the long saphenous vein (tributaries of femoral vein).

Venous anastomoses in the anterior abdominal wall:

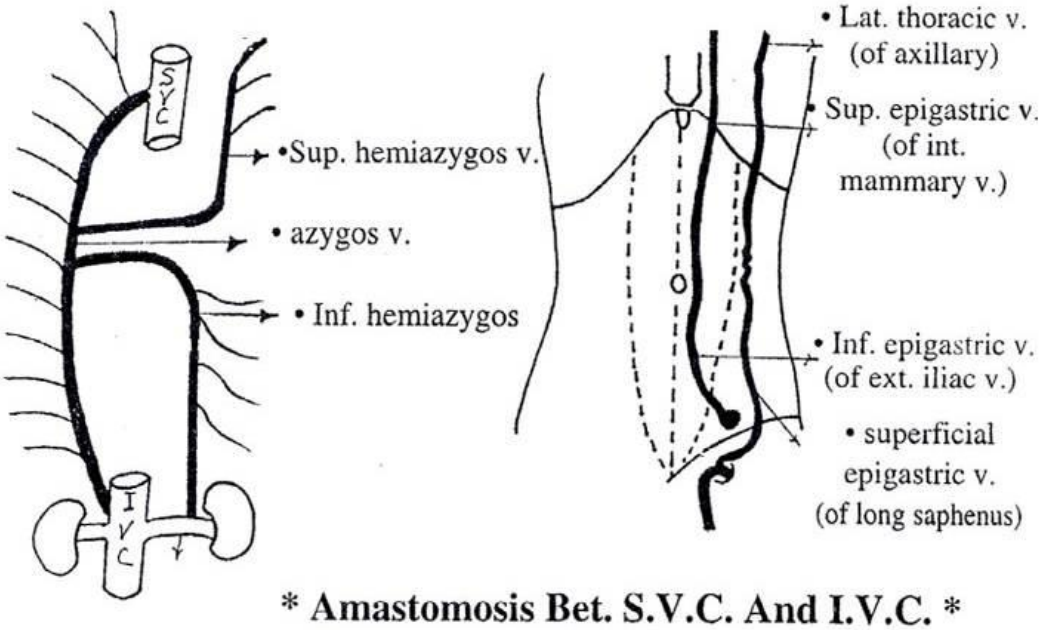
1. Anastomosis between the ***superior and inferior epigastric*** veins in the rectus sheath.It connects the superior and inferior venae cavae.
2. Anastomosis between the ***lateral thoracic*** vein and ***superficial epigastric*** veins. This anastomosis forms the ***thoraco-epigastric vein*** which connects the superior and inferior venae cavae.

Applied anatomy:

Obstruction of inferior vena cava or iliofemoral veins, results in opening of this anastomosis with formation of ***dilated veins crossing the groin***.

3. Anastomosis between systemic veins of the anterior abdominal wall (tributaries of superior and inferior venae cavae) and para-umbilied veins (tributaries of portal vein).

- Opening of this ***porto-systomic anastomosis*** in portal hypertension results in formation of **caput medusae**.



*** Amastomosis Bet. S.V.C. And I.V.C. ***

LYMPHATIC DRAINAGE OF ANTERIOR ABDOMINAL WALL

A) Superficial lymphatics: (follow veins)

1) ***Above the umbilicus:*** drain into the pectoral group of axillary lymph nodes.
2) ***Below the umbilicus:*** drain into the superficial inguinal lymph nodes.

B) Deep lymphatics: (Follow arteries)

1) ***Above the umbilicus:*** drain into the parasternal lymph nodes (along internal thoracic artery).
2) ***Below the umbilicus***: drain into the external iliac lymph nodes.

3) The ***deep surface of the umbilicus*** is drained by lymphatics around the ligamentum teres, in the falciform ligament, which drain in the lymph nodes in the porta hepatis.

NERVES OF ANTERIOR ABDOMINAL WALL

A) Motor supply:

a) **The lower five intercostal and subcostal nerves:**

- They ***supply*** the three antero-lateral muscles of the abdominal wall.
- They pass through the ***neuro-vascular*** plane of the abdominal wall (between the internal oblique and the transversus abdominus), then enter the ***rectus sheath*** to run between the rectus abdominis and the posterior wall of rectus sheath.
- They pierce the rectus abdominis after supplying it and pierce the anterior wall of rectus sheath to end by becoming the anterior cutaneous nerves lateral to the linea alba.

b) **Iliohypogastric and ilioinguinal nerves**: (branches of the anterior primary ramus of L_1).

- They **pierce the psoas** major muscle to emerge from under cover of its **lateral border** and descend laterally on the **quadratus lumborum** muscle, behind the kidney with the

iliohypogastric lying at a slightly higher level than the ilioinguinal nerve.

- **B**oth nerves pierce the transversus abdominis muscle and run forwards in the **neurovascular plane** between the internal oblique and the transversus muscles (supplying both) until they reach the level of anterior superior iliac spine; then they pierce the internal oblique at variable points and continue medially between it and the external oblique as cutaneous nerves.
- The ***iliohypogastric*** nerve pierces the aponeurosis of the external oblique about 2 – 3 cm above the superficial inguinal ring to supply the skin above the symphysis pubis.
- On the other hand, the ***ilioinguinal nerve*** pass in the inguinal canal below the spermatic cord emerges through the superficial inguinal ring, to supply the skin of the external genitalia and upper part of medial side of the thigh. It also supplies the conjoint tendon.

B) Sensory supply:

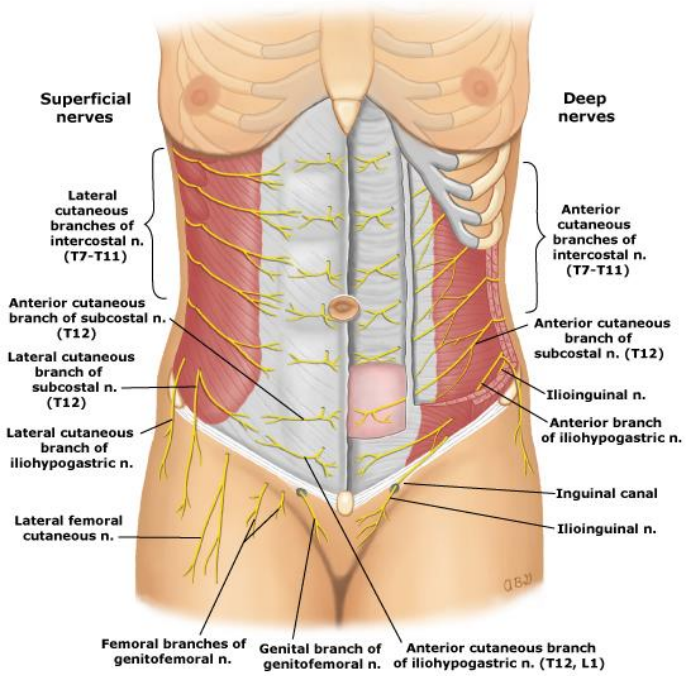
1. Lateral cutaneous branches of the ***lower five intercostal and subcostal nerves.***
2. Anterior cutaneous branches of the lower five intercostals and subcostal nerves

3. Cutaneous branch of the ***iliohypogastric*** nerve.

4. Cutaneous branches of the ***ilioinguinal*** nerve. They supply the skin of the scrotum and the upper part of medial side of the thigh.

* The lower five intercostal and subcostal nerves and the branches of L_1 supply successive and almost horizontal bands of the skin of the anterior abdominal wall.

  - Skin at the subcostal angle is supplied by 7^{th}. thoracic nerve (T_7).
  - Three nerves ($T_{7, 8, 9}$) supply the region above the umbilicus.
  - Skin at the level of the umbilicus is supplied by 10^{th}. thoracic nerve (T_{10}) (as that of the appendix).
  - Three nerves ($T_{11, 12,} L_1$) supply the region below the umbilicus.
  - Skin above the symphysis pubis is supplied by the iliohypogastric nerve (L_1).



ABDOMINAL INCISIONS

REQUISITES OF GOOD INCISION:

1. Maximum accessibility.
2. Extensible.
3. Minimal scar after healing.
4. Minimal damage to the muscles.
5. Avoid nerve injury to avoid paralysis of muscles .
6. Minimal bleeding.
7. Rapid healing time.

TYPES OF ABDOMINAL INCISIONS:

1. The midline incision (through the linea alba):

This incision may be upper or lower , right or left .

- **Advantages:**

It provides a bloodless field.

Could be extended above or below.

- **Disadvantages:**

Prolonged healing time due to poor blood supply of the linea alba.

2. The Paramedian incision:

- **Method:**

This is done 2.5 – 4 cm. lateral to the midline and parallel to it. The anterior rectus sheath is opened, the rectus muscle is retracted laterally and the posterior wall of rectus sheath along with the parietal peritoneum are opened in the same plane as the skin incision.

- **Advantages**:

It provides a bloodless field.

Could be extended.

Good healing in a short time as the rectus abdominis provides the incision with its arterial supply.

3. Transverse incision:

In this incision muscle is cut through the lateral abdominal muscles in order toexpose some organs .eg: ***Pfannenstiel incision*** for the uterus .It may lead to some weakness of the abdominal muscles.

4. Right or left subcostal incision:

- It is used to expose the gall bladder on the right side or the spleen on the left side.The skin incision begins at the middle line and extends one inch below and parallel to the costal margin.
- **Advantage:**

  good exposure.
- **Disadvantage:**

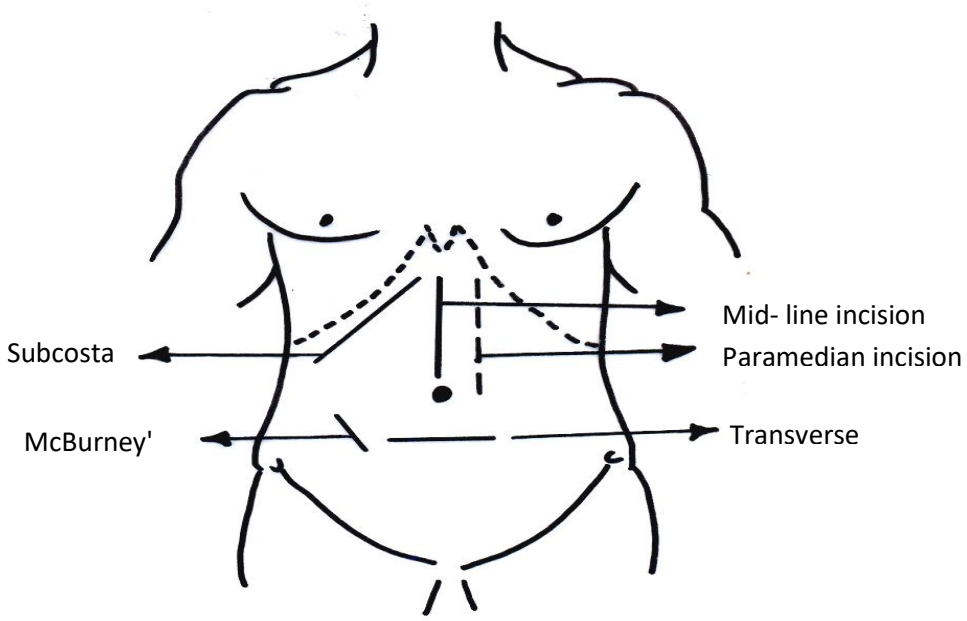
  a muscle cutting incision with high incidence of incisional hernia.

5. McBurney's incision (grid iron):

- It is done to expose the vermiform appendix.
- **Method:** An oblique incision centered at Mc Burney's point (point at the junction of the lateral 1/3 and medial 2/3 of a line extends from the umbilicus to the anterior superior iliac spine).Open the external oblique, internal oblique and the transversus abdominis (***without cutting them***) in the line of their

fibers and retract them. Next open the fascia transversalis and parietal peritoneum.

- **Advantage:** a ***muscle splitting*** incision with no damage the abdominal muscles.



WOUND CLOSURE IN LAYERS

Closure of the Abdominal Incision

Closure of the abdominal wall is a challenge of all abdominal surgery. It is one of the first things that surgery training during residency. The methods of closure are often based on local traditions and the preferences of the teacher, and the surgeon is often reluctant to change these methods later on in his or her career. Abdominal closure is

performed in a multitude of fashions and there are an abundance of differently tailored studies on this matter.

The goal of wound closure is to restore function of the abdominal wall after a surgical procedure. The optimal method should be so technically simple that its results are as good for the hands of the trainee as they are for the experienced surgeon. It should leave the patient with a reasonably aesthetic scar, and most importantly, it should minimize the frequency of wound rupture, incisional hernia, wound infection, and sinus formation.

Closure of the Peritoneum

Traditional surgical dogma tells since all tissue layers of the abdominal wall are opened during an abdominal incision, all layers should be approximated when the incision is closed. Closure of the peritoneum is done in the premise that normal anatomy will be restored, the risks of infection will be reduced and wound herniation will be reduced, and adhesions will be minimized.

But in recent studies it has found no difference in the incidence of wound dehiscence or hernia between the nonclosure of peritoneum (3.0% and 4.3%, respectively) and the closure of peritoneum (2.5% and 4.3%, respectively).

Similar results have been reported found in randomized trials comparing closure versus nonclosure of the peritoneum in open cholecystectomy incisions, lateral paramedian incisions and gynaecologic and obstetric incisions. From these studies it is concluded that closure of the peritoneum is not necessary and not recommended. It is associated with longer operative time and most importantly closure of peritoneum produces postoperative pain, and there are some suggestions that it may even cause increased formation of adhesions.

Closure of the Fascia

Closure of the abdomen can be done in layers or en mass. A layered closure technique reconstructs the anterior and posterior aponeurotic sheaths in two different layers with the posterior layer generally involving the peritoneum. Mass closure involves a single-layer closure of all musculofascial layers and may or may not include the peritoneum. Numerous clinical trials have compared layered to mass abdominal closure.

Some studies have shown an increased incidence of wound dehiscence and incisional hernia with layered closure, and some studies show no difference in these complications, but no studies demonstrate an advantage of layered over mass closure. Rates of wound sepsis and sinus

formation have also been studied in randomized trials and do not depend on closure technique.

It has been claimed that a continuous, running suture will result in more secure wound closure than a series of sutures placed in an interrupted fashion. The theoretical advantage of a continuous closure is the distribution of tension differences across the suture line and the ability of the wound to adjust to the stresses and strains of the postoperative period.

This should minimize tissue strangulation and wound rupture from suture under strain cutting through fascia. The disadvantage of the continuous closure method is that a single thread holds the fascia together and its breakage jeopardizes the entire wound. Clinical evidence, however, demonstrates that continuous and interrupted closures of the abdomen are responsible for similar incidences of wound dehiscence, incisional hernia, wound infection, wound pain, and suture fistula.

The use of reabsorbable versus nonreabsorbable suture in closing the fascia has long been debated. Rates of 17% for scar pain and 8% for suture fistula using permanent suture have stirred interest in the use of reabsorbable sutures. Reabsorbable sutures, however, bear an intrinsic

loss of tensile strength during the vulnerable postoperative period, and may result in an increase in wound disruption and ventral hernia.

The early use of the absorbable catgut suture has been shown to lead to a high incidence of wound rupture and incisional hernia due to its early degradation.

To overcome this problem, synthetic absorbable sutures with delayed degradation were introduced to combine the advantages of absorbability with strength comparable to nonabsorbable materials.

There are conflicting reports in the literature about wound failure when nonabsorbable and absorbable suture are compared in randomized clinical trials.

The resorbable sutures polyglycolic acid (Dexon), polyglactic acid (Vicryl), polydioxanone (PDS), and polyglyconate (Maxon) have been shown to be equally as effective as nonabsorbable suture with respect to wound dehiscence and incisional hernia.[31-34] Other studies, however, demonstrate that polydioxanone and polyglactic acid polymer absorbable suture may be associated with an increased incidence of incisional hernia when weighed against nonabsorbable suture.

Another choice is monofilament versus multifilament suture. Multifilament suture is known to provide a better growth environment for bacteria and is associated with a higher incidence of wound sepsis when

compared to monofilament suture. Bacteria are drawn into the fibers of multifilament suture by capillary action and thrive there by escaping phagocytosis. Wound sepsis is a major risk factor for incisional hernia, but despite these considerations, multifilament suture has not been shown to result in a greater incidence of wound failure over monofilament closure. . Monofilament catgut suture also deserves special consideration.

It is a reactive material that causes a marked inflammatory reaction and is associated with a higher incidence of wound infection than other monofilament materials.

Our experience and interpretation of the literature is that the optimal surgical method of closing the abdominal wound is a continuous mass closure. This technique appears to reduce the incidence of wound rupture, is considerably less time consuming, is less expensive, and does not increase the incidence of incisional hernia, wound infection, or sinus formation. The choice of suture material is more complex.

We prefer to use a resorbable suture with delayed degradation, such as polydioxanone. Other resorbable materials are appropriate as well, but catgut should not be used. Among nonresorbable sutures, monofilament suture is recommended.

Subcutaneous Tissue Closure

With the high prevalence of obesity in developed countries, treatment of the subcutaneous tissues in abdominal wound closure becomes increasingly important.

The vascular supply to the subcutaneous tissue of the abdominal wall is poor, rendering it susceptible to soft-tissue infection. Likewise, if this level of the abdominal wall contains a potential space promoting accumulation of seroma, the risk of infection increases.

Only one prospective randomized trial has been conducted to determine the value of suturing the subcutaneous fat. Using a subcostal incision for cholecystectomy, the authors demonstrated no significant differences in complications between closure and nonclosure of the subcutaneous tissues. Wound seepage, however, was reduced in incisions in which the subcutaneous layer was closed.

A separate trial failed to demonstrate any benefit of suture closure in wounds with less than 2 cm of subcutaneous tissue, but confirm the reduction in wound disruption in wounds with greater than 2 cm of tissue.

We do not routinely close the subcutaneous layer of the wound. On some occasions, in obese patients, we will employ the use a series of simple, interrupted, absorbable polyglactic acid (vicryl) sutures to

reapproximate the subcutaneous layer. These stitches are inverted to bury the knots within the wound.

Skin Closure

If the surgical site is heavily contaminated (class III or class IV wound), the skin should be left open to heal by secondary intention or by delayed primary skin closure. A number of closure techniques for clean (class I) and clean-contaminated (class II) wounds are available for the skin. These include interrupted suture, subcuticular suture, surgical staples, surgical tape, and adhesive glues. Goals of skin closure are tissue approximation, minimizing wound infection, acceptable cosmesis, and minimizing postoperative pain.

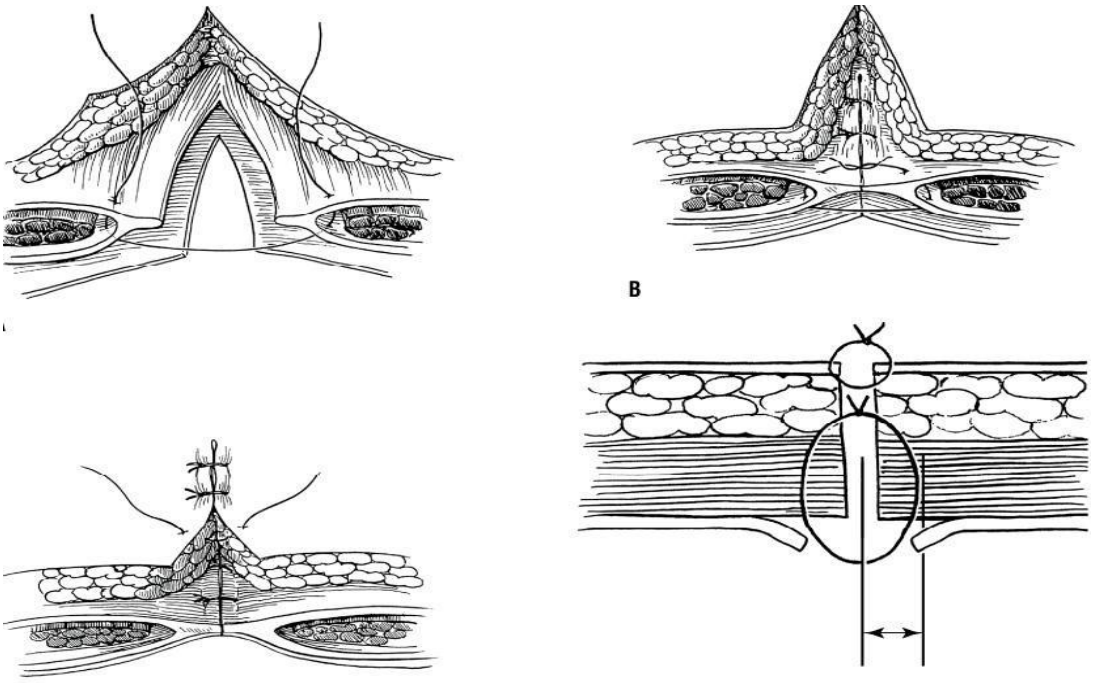
These goals should be achieved with a simple, rapid, and cost-effective method. Three randomized controlled studies have compared skin staples to subcuticular sutures. In all studies, no difference in the rate of wound infection could be demonstrated. Two of these studies revealed less postoperative pain and less postoperative analgesia requirement in wounds closed with subcuticular suture. Two of these studies also demonstrated a superior cosmetic result in subcuticular closures over surgical staples; however, this cosmetic difference narrowed over time and became insignificant by 6 months.

Adhesive tapes are often used to reapproximate skin edges in simple lacerations. Following abdominal surgery, adhesive tapes are useful to cover skin incisions closed by subcuticular suture, where they serve to further reapproximate skin edges and to dress the wound. The use of adhesive tape without suture closure was compared to interrupted silk skin suturing of abdominal wounds in one early trial. No difference in the rates of wound infection could be found. The tapes were significantly more comfortable and patients preferred them over sutures, but wide scarring occurred more frequently with surgical tapes.

Synthetic glues are gaining popularity in skin closure of surgical wounds. When compared with traditional skin-closing devices including sutures, staples, or adhesive tapes, some cyanoacrylate glues have been found to be comparable in effectiveness and safety for repair of lacerations.

They are applied more rapidly and decrease the amount of required wound care by serving as their own dressings. In elective abdominal procedures with small and large (>4 cm) incisions, these glues have been shown in clinical trials to have similar outcomes with respect to wound durability when compared to traditional techniques, although there are conflicting data on wound healing, cosmesis, and postoperative pain. We prefer to close skin with a running, nonbraided, absorbable suture in a

subcuticular technique. Adhesive tapes are placed over the closed incision without the use of skin glues.



STAGES IN MASS CLOSURE OF MIDLINE ABDOMINAL INCISION

NORMAL WOUND HEALING

The ideal response to wounding, as seen in lower forms of life, is total regeneration with reconstitution of the original structure. This is lost to a great extent in phylogenetically advanced organisms, leading to repair by scar formation. This in turn has lead to complications like delayed healing, contractures, weak scars, stenoses, adhesions and proliferated scars, etc.

It has always been recognized for long that the efficacy and the speed of repair are influenced by some factors relating to the part as well as to the local milieu. The recent advancements in our knowledge about collagen structure and chemistry as well as the role of the various soluble factors, matrix proteins, angiogenesis, and fibroblastic proliferation in wound healing has induced several studies to modulate and manipulate these factors to optimize healing with minimal yet strong scar. Most of the work has involved healing of skin wounds as this is most easy to control, modulate and study.

PROCESS OF WOUND HEALING

Healing involves regeneration and repair by scar formation. Regeneration requires two criteria to be fulfilled.

- The tissue should comprise of labile or stable cells, i.e. be capable of replication e.g. most epithelia and some of the other connective tissues.
- The structural framework should be intact .In all other situations repair with scar formation occurs through the medium of granulation tissue.

HEALING BY 1st INTENTION OR PRIMARY UNION

In a clean surgical wound, with approximation of the edges, the following phases occur in a continuum with overlap.

1. **Acute inflammation**:

Starts soon after wounding and is well established by 24 hours. This results in

- Vascular response & coagulation cascade activation formation of clot primary wound binding as well as fibrin scaffold for later events.
- Platelets and inflammatory cells accumulated and secretion of several Growth factors. By 24 hours inflammation is established and predominantly neutrophilic, to be replaced by macrophages by day 3.

2. **Epithelialisation:**

Starts within 24 hours, as mitotic activity in few cells peripheral to the discontinuity, along with migration of proximal cells towards the gap. A continuous monolayer over the clot forms by 48 hours, followed now by increase in number of layers and maturation by 5-7 days. Basement membrane is deposited concurrently.

3. **Granulation Tissue Formation:**

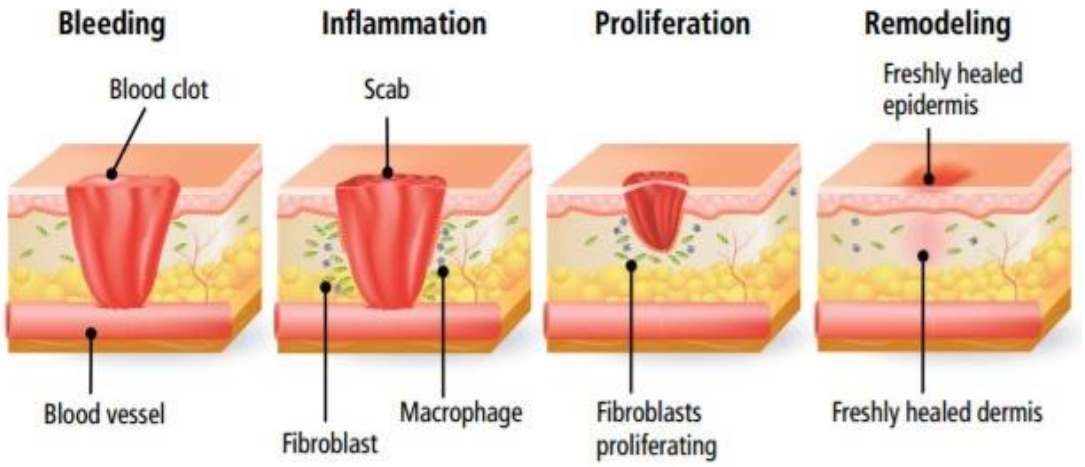
Comprising of angiogenesis and fibroblastic proliferation and migration. Proliferation starts by 24 hours. and granulation tissue formation by 3-5 days. **Angiogenesis** occurs by proteolysis of basement membrane of existing capillaries, outward migration of endothelium with proliferation proximal to leading edge, maturation into capillary tubes and reformation of basement membrane. The proliferated fibroblasts have contractile filaments and are also called **myofibroblasts.**

4. **Fibroplasia:**

Collagen deposition in the extracellular matrix is demonstrable by 3-5 days and progressively increases. Fibroblasts synthesise the three chains. These are secreted as triple helix after hydroxylation and glycosylation. They are then spliced in the extracellular matrix followed by linking and fibril formation. Crosslinking of these results in fibre formation. By one week the wound strength is 10% of normal skin. Continued crosslinking & structural modification increases the strength rapidly till 4 weeks, after which it slows to a plateau by three months at 70% to 80% of normal. Simultaneous devascularisation and subsiding of inflammation causes blanching of the scar.

5. **Remodelling:**

Degradation of collagen occurs simultaneously with synthesis leading to reorientation of fibres across stress lines. Though maximal strength is attained by 3-6 months, remodelling may continue till 6-12 months leading to a flat, mature scar. Degradation is carried out by **metalloproteases,** which are promoted by some of the growth factors, and kept in check by Tissue inhibitors (TIMP).



SECONDARY UNION

This occurs where wound edges are not approximate (eg. Ulcer), resulting in a gap to be filled. Though the steps are the same, it differs from Primary union in the following respects:

- **Epithelialisation**

  occurs over the granulation tissue and hence starts later (by 4-5 days) and takes longer.

- **Granulation tissue**

  is more exuberant (proud flesh) and may need to be trimmed for optimal healing. Resulting scar is larger and takes longer to form.

- **Wound contraction**

  This is decrease in size of gap to be filled and occurs between 3-14 days. It is mediated by the contractile action of myofibroblasts and can reduce the gap by upto 80% thereby decreasing the time taken for healing as well as scar size.

FACTORS AFFECTING WOUND HEALING

General and local that affect wound healing are:

1) General:

Nutritional Deficiency:

Protein deficiency, especially chronic deficiency of methionine and cysteine decreases production and cross linking of collagen. Vitamin C affects the intracellular hydroxylation of procollagen fibres, essential for helix formation . Zinc is essential for activity of metalloproteases.

Age:

Wounds heal better in the young than in the old. This is due to age perse or associated vascular and nutritional status . There is a fall in collagen production as well as cross linking in the elderly.

Steroids:

Glucocoticoids suppress angiogenesis and wound contraction . They also suppress collagen synthesis by attenuating heat shock protein which plays a key role in protein assembly and packaging. DOCA and anabolic steroids promote healing.

a. Within normal ranges of ambient temperature, higher temperature quickens and cold slows down healing.

b. Certain drugs like NSAIDS (Ibuprofen) compromise collagen density and wound strength in experimental animals.

c. Diabetes mellitus*:* Healing is affected mainly due to the micro-angiopathy.The associated neuro-pathy, immune derangement and hyper glycaemia do not play a major role. Neuro-pathy*:* Denervation does not affect healing. However the repeated trauma in an area of sensory loss hampers the healing process.

2) Local:

Tissue O2 is an important factor which gets affected by anaemia, cardio-respiratory problems and smoking or by ischemia, stasis or by vasculitis. Deficient tissue O_2 affects all stages of wound healing. Excessive and continuing inflammation as in the presence of infection or foreign body delays healing and results in poor scar. Radiation exposure inhibits wound contraction and delays healing. UV exposure in contrast has been shown to promote healing .Drying of surface inhibits epithilialisation. Mobility (as against fixity to bone) favours healing though movement hampers healing as well as modulates orientation of collagen bundles .Direction of wound in relation to natural folds and creases. Tension across incision and exessive collagenisation leads to disfiguring large scar / contracture. Dermal / subcutaneous support is important in wounds which have tension across them. Certain anti-bacterials are cytotoxic to fibroblasts and delay healing. FGF is shown to protect.

SOLUBLE FACTORS IN WOUND HEALING

Several **growth factors** released from damaged tissue as well as native and infiltrating cells are now recognized as important in prolifeation and migration of cells as well as in collagen synthesis. Their effects have been demonstrated in experimental and in-vitro situations with a goal towards uncomplicated healing and ideal scar **(Also scarless healing)** Some of the important ones and their actions are as follows:

- PDGF Chemotactic to inflammatory cells, migration of endothelium & fibroblasts and mitogenic to fibroblasts.
- EGF/TGFα proliferation of epithilial and mesenchymal cells and fibronectin synthesis.
- FGF (esp. basic) a Potent angiogenesis a mitogenic to endothelium & fibroblasts and collagen deposition.
- TGF β Fibroblast migration and collagen deposition by differentiation and mitogenic Inhibition.
- KGF (rel. to FGF) a Proliferation and differentiation stimulus to epithelium.
- IGF-1 a Synthesis of proteoglycans, fibroblast and endothelial proliferation and chemotactic to macrophage.
- IL-1 & TNF a Fibroblast proliferation, collagen synthesis &degradation.

WOUND DEHISCENCE:

Partial or complete separation of an abdominal wound with protrusion (evisceration) of abdominal contents

- Wound dehiscence & incisional hernia are part of the same wound failure process
- Distinguished by timing and healing of overlying skin

PARTIAL

separation of fascial edges without evisceration with loose fascial sutures. occasionally, fibrin covered intestinal loops

COMPLETE

full separation of fascia & skin ,intestinal loops (if not glued by fibrin) eviscerated

Clinical manifestations

- Evident day 7 – 14
- May develop without warning, following straining or removal of sutures
- May be preceded by a sero-sanguineous discharge

ETIOLOGIC FACTORS OF ABDOMINAL WOUND DEHISCENCE

Etiology of wound dehiscence

Following are the factors responsible for wound dehiscence

- Faulty technique of fascial closure
- Emergency surgery
- Intra abdominal infections
- Malnutrition
- Advanced age
- Chronic steroids use
- Wound complications (Hematoma – infection, seroma)
- Previous wound dehiscence
- Increased intra abdominal pressure (coughing, abdominal distension)
- Radiation therapy and chemotheraphy,Systemic disease (uremia, diabetes mellitus)

Wound Infection:

The most common causative factor in the development of wound dehiscence is wound infection.Wound infection causes impaired wound healing by interfering with normal healing, resulting in a wound which has less collagen also the collagen is not highly cross linked as in a normally healed wound. This weakness leads to later postoperative abdominal wound dehiscence.

Abdominal Incisions:

The lower incidence of wound dehiscence in the transverse or oblique incision is due to low tension in the suture line in the transverse or oblique incision compared to those over the midline, however this have not been proved clinically. Similarly higher rate of wound dehiscence in incisions in the upper abdomen when compared to that in lower abdomen also has not been proved by clinical studies yet. But clinical studies have proven that wound dehiscence is very low in muscle splitting incision. but the disadvantages of this incision is they a limited access to the abdominal cavity.

Sutures and suture technique:

Absorbable suture materials that lose their 80% of their tensile strength within 14days,thus wound dehiscence are more common when they are used for closure.

Multifilament suture materials are associated with more wound infection because bacteria are being enclosed within the interstices of multifilament sutures, where they are protected from phagocytosis.

If a single suture in an interrupted closure is very tight, ischemia will develop in the tissue enclosed. In interrupted closure technique more knots, more foreign materials will be deposited in the rectus leading to wound infection and sinus formation. The rate of incisional hernia is more if the SL:WL ratio is less than 4. If the stitch length is more than 5cm rate of wound infection is high. Excessive tension placed on the suture reduces local blood flow leading to necrosis of that area and is associated with increased wound infection.

Age:

Wound dehiscence increases as the age of the patient increases. The reason for poor Wound healing in older patients is not only due to age but also due to the extent of dissection and the potential for intra operative contamination are greater in operations conducted in older patients (i.e., extensive resection for cancer).

Obesity:

Excessive fat in the omentum and the subcutaneous tissue results in increase strain on the wound with all body movements in the early postoperative period. Associated poor muscle tone and lack of muscle

mass also are causative factors in the development of wound dehiscence. Surgery in obese patient is associated with an increased potential for postoperative pulmonary complications, wound infection and pulmonary embolus.

Debility and Malnutrition:

Malnourished patients, particularly those who have lost a significant amount of weight over a relatively short period as seen in those patients with malignancy and chronic diseases before operation have poor wound healing and immunity and hence they have high chance of wound dehiscence. This malnutrition can be assessed by levels of serum albumin and other proteins these patients are at higher risk for poor wound healing.

Carbohydrates

Carbohydrates, together with fats, are the primary sources of energy in the body and consequently in the wound healing process. The energy requirements for wound healing consist mainly of the energy required to carry out collagen synthesis in the wound.

Fatty acids

Several unsaturated fatty acids must be supplied in the diet as deficiencies of these lipids cause impairment in wound healing in animals and humans. This impairment is due to the role phospholipids

play as constituents of the cellular basement membrane and the participation of prostaglandins in cellular metabolism and inflammation. Total parenteral nutrition (TPN) is the most common cause of essential fatty acid deficiency.

Vitamin C:

This vitamin plays a very important role in the development of wound dehiscence. vitamin c is needed for the cross linking of the collagen fibers .deficiency of this leads to faulty cross linking leading to poor wound healing and contraction which ultimately leads to wound dehiscence

Branched-chain amino acids

The branched-chain amino acids valine, leucine and isoleucine have been used to treat liver disease and have an additional role in retaining nitrogen in sepsis, trauma, and burns. Branched-chain amino acids support protein synthesis serve as caloric substrates. Despite these useful properties, high supplements of branched- chain amino acids have not proved to be of any significant benefit in improving wound healing.

Glutamine

Glutamine is the most abundant amino acid in the body. The process of gluconeogenesis involves the shuttling of alanine and glutamine to the liver for conversion to glucose, which is used peripherally as fuel to power certain aspects of wound healing. Glutamine also is an important precursor for the synthesis of nucleotides in cells, including fibroblasts and macrophages. Glutamine is as an energy source for lymphocytes and is essential for lymphocyte proliferation. Finally, glutamine has a crucial role in stimulating the inflammatory Immune response occurring early in wound healing.

Postoperative Pulmonary Complication :

Immediately after surgery buking due to improper anaesthesia technique or vigorous coughing during sedation aggravated due to the underlying lower respiratory tract infection, will produce tear in the suture line. Also postoperative coughing and straining are also etiologic factors for subsequent wound dehiscence.

Steroids:

The use of steroids has negative effect to wound healing. Wounds heal poorly in patients receiving long term steroid therapy ,the reason for this being, the normal inflammatory responses that are necessary to

initiate wound healing are lost with chronic steroid use with consequent impaired deposition and polymerization of collagen in the wound.

Chemotherapy:

The early postoperative administration of chemotherapy is associated with impaired wound healing. This is the reason why medical oncologist prefer to give chemotherapy to malignant patient who have been operated after wound have healed.

Ascites:

Patients with cirrhosis and ascites not only have increased abdominal pressure caused by peritoneal fluid, but also often are severely malnourished.

Peritoneal Dialysis:

The patients undergoing continuous ambulatory peritoneal dialysis will have uremia ,obesity, marked anaemia, and chronically elevated intraperitoneal pressure caused by presence of the dialysate ,these all factors will lead to the development of wound dehiscence.

Type of surgery:

Certain types of surgeries have an increased chance of wound dehiscence. These include

- laparotomy for generalized or localized peritonitis,
- perforated peptic ulcer surgeries,
- appendicitis,
- diverticulitis,
- acute pancreatitis,
- intra abdominal malignant diseases,
- chronic inflammatory bowel disease
- Re-surgery through the same incision within the 1st 6month of surgery.

The cause of the wound dehiscence is not due to the surgery but due to the presence of the above mentioned factors.

Type of surgical wounds

Surgical wounds are classified based on the presumed magnitude of bacterial load at the time of surgery.

Clean wounds (Class I)

Wounds which don't have infection, only skin microfolora potentially contaminate the wound, and no hollow viscus that contains microbes is entered.

Class ID wounds are similar except that a prosthetic device (mesh) is inserted.

CLEAN / CONTAMINATED (CLASS II) :

Wound in which a hollow viscus such as the respiratory, alimentary or genitourinary tracts with indigenous bacterial flora is opened under controlled circumstances without significant spillage of contents.

Eg: Elective colorectal cases have classically been included as class II cases,

CONTAMINATED WOUNDS (CLASS III)

Wound include open accidental wounds encountered early after injury, those with extensive introduction of bacteria into a normally

sterile area of the body due to major breaks in the sterile technique, gross spillage of viscus contents such as from the intestine

eg: perforation.

DIRTY WOUNDS (CLASS IV)

Wound include traumatic wounds in which a significant delay in treatment has occurred and in which necrotic tissue is present, these contain overt infection as evidenced by the presence of purulent material, and those created to access a perforated viscuss accompanied by a high degree of contamination.

Miscellaneous Factors:

There are numerous factors responsible for wound dehiscence. There are etiologic factor cannot be identified in every patient without a wound dehiscence. The role of certain minerals like zinc and manganese in extra cellular fluid has not been established definitively, although they are thought to influence the maintenance of connective tissue integrity. The effect of the anticoagulants such as warfarin sodium have adverse effect on fibrinogenesis by decreasing the fibrogenesis. Both Warfarin and heparin increase postoperative wound haematoma, modestly increasing the risk of incisional hernia.

PREVENTIVE MEASURES FOR ABDOMINAL WOUND DEHISCENCE

Most of the factors responsible for wound dehiscence cannot be corrected preoperatively or cannot be influenced by the surgeon.

Patient age or over weight cannot of course be influenced, when an emergency laparotomy of a grossly contaminated abdomen is required. However the suture technique which is completely in the hands of the surgeon ,which is one of the most common cause for wound complications can be corrected.

Incisions:

The choice of laparotomy incision depends on the time it takes to open and close the abdomen. The access and the visualisation of the required organ must be considered. The rate of wound complications varies with midline, paramedian, lateral paramedian, oblique, transverse and muscle -splitting incisions. When restricted access to the abdomen is sufficient, muscle -splitting incisions is recommended because of the much much lower wound complications .the reason for this being , the muscles produce a shutter mechanism that tends to close the wound.

Suture Materials:

Monofilament suture materials are associated with a lower rate of wound infection when compared to the multifilament .the reason for this being the bacteria being enclosed within the interstices of multifilament sutures and they get protected from phagocytosis.

Non absorbable suture materials allow support of the wound during the entire healing period and have been used with good results. With slowly absorbable monofilament suture materials that retain an acceptable strength for atleast 6week.

The method of wound closure:

The laparotomy incisions should be closed by a continuous suture technique in single layer. Why this is preferred is, less foreign material and minimal knots are deposited ,this also allows tension to adjust evenly along the suture line in stead of spreading over a single knot. intermittent Self-locking knots should be used for the anchor knot.

In vertical midline incisions, sutures taken should mainly include aponeurotic tissue and be placed at least 1cm from the wound edge. The length of each suture should be less than 5cm; otherwise it will be associated with an unnecessary high rate of wound infection. Including peritoneum, muscle or subcutaneous fat in the suture is not needed as this doesn’t have any advantage infact it has adverse effects on wound

healing. The surgeon should be careful not to place excessive tension on the suture.

Wound infection:

In wounds that are expected to have intra- operative contamination, the incidence and subsequent infection is reduced by administration of appropriate antibiotic prophylaxis. The following pre requisite are to be followed

- gentle tissue dissection,
- use of minimal amounts of suture material
- use of minimal amounts of electrocautery,
- avoidance of stoma through the wound,
- irrigation of the wound during closure to remove debris, blood clots and foreign matter,
- meticulous haemostasis reduces the incidence of wound dehiscence.

MANAGEMENT OF WOUND DEHISCENCE:

Treatment of wound dehiscence depends on

- extent of fascial separation
- presence of evisceration
- significant intraabdominal contamination.

A small dehiscence in upper aspect of upper midline incision can be managed conservatively. This can be done by with saline-moistened gauze and using an abdominal binder. If evisceration of content is seen then the eviscerated intestines must be covered by sterile, saline-moistened towel then the patient must be shifted to operation theatre after fluid resuscitation. In emergency theatre , through exploration of the abdominal cavity should be done to rule out presence of septic focus or an anastomotic leak that would have predisposed to the dehiscence. Treatment of infection is of critical importance before attempting closure.

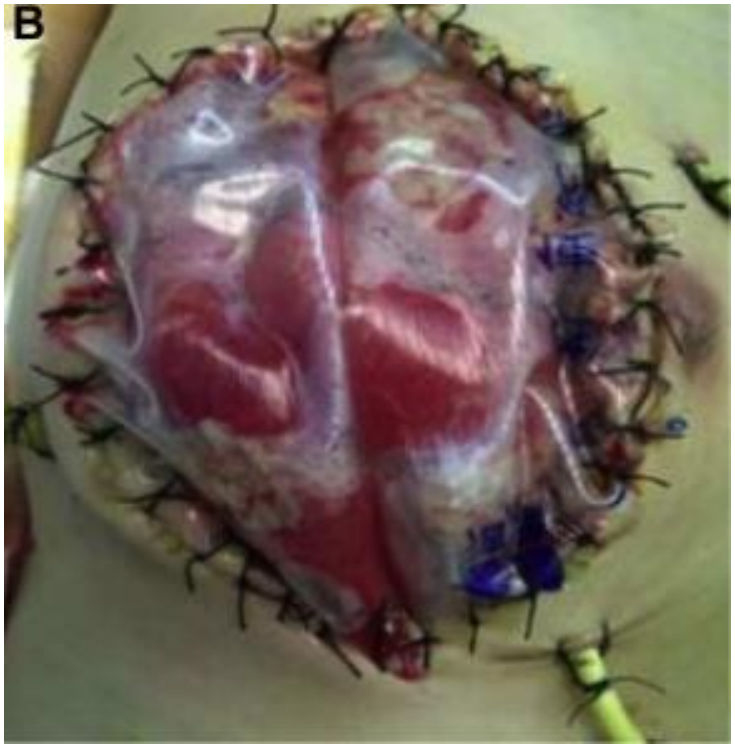
When technical mistakes are made which had lead to the wound dehiscence and the fascia is strong and intact, then primary closure is can be done. If the fascia is infected or necrotic, debridement is done first ,which is then followed by examination about the approximation of the fascia. If after debridement the edges of the fascia cannot be

approximated without tension, then fascia can be closed with absorbable mesh or the recently developed biologic prosthesis

TENSION SUTURES

If the fascia is closed under tension then there is a chance of repeat dehiscence and increased intra-abdominal hypertention. Definitive surgical repair to restore the integrity of abdominal wall will be needed if absorbable mesh is used.this will not be needed if a biologic prosthesis is used.

Autologous skin grafts are used to reconstruct the epithelial barrier, and flaps are used to reconstruct the abdominal wall.



BOGOTA BAG

For short term management of a infected dehisced wound, a wound vacuum therapy can be used.this therapy consist of open cell foam placed on tissue, semi occlusive drape is applied over it to cover the foam and skin of patient , and suction apparatus.this can be added with a continuous irrigation of saline to wash away the debris.

The wound vacuum system provides immediate coverage of the abdominal wound acts as a dressing that minimizes heat loss and does not require suturing to fascia. By using negative pressure, the device removes interstitial fluid and hence this also reduces the bowel edema,It also causes the contraction of wound, reduces bacterial colonization, increases

blood flow to the skin, and promotes the healing response. Successful closure of the fascia can be achieved in 85% of cases of abdominal wound dehiscence. The drawbacks of this technique, is evisceration, intestinal fistulization, and hernia formation.

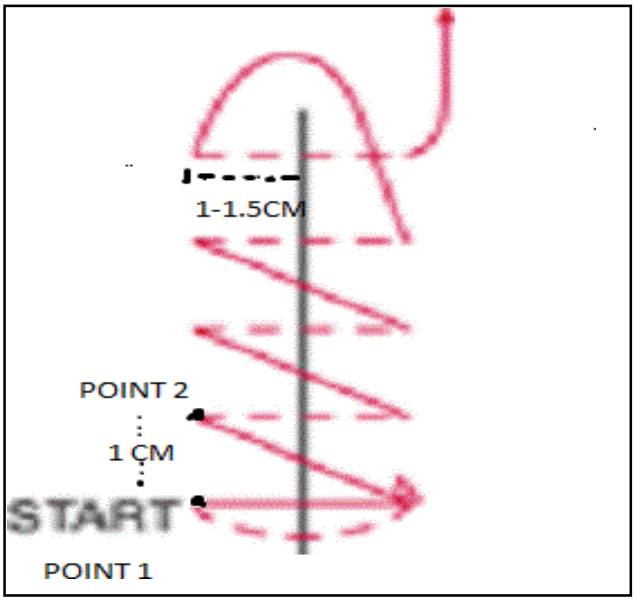
VACCUM ASSISTED DRESSING

SEVERAL PREVENTIVE STRATEGIES

- Smead-Jones technique (1941)
- May/Mary closure
- Retention sutures
- Interrupted X-suture
- TI, TIE and TIES incisions
- Far-and-near double horizontal mattress

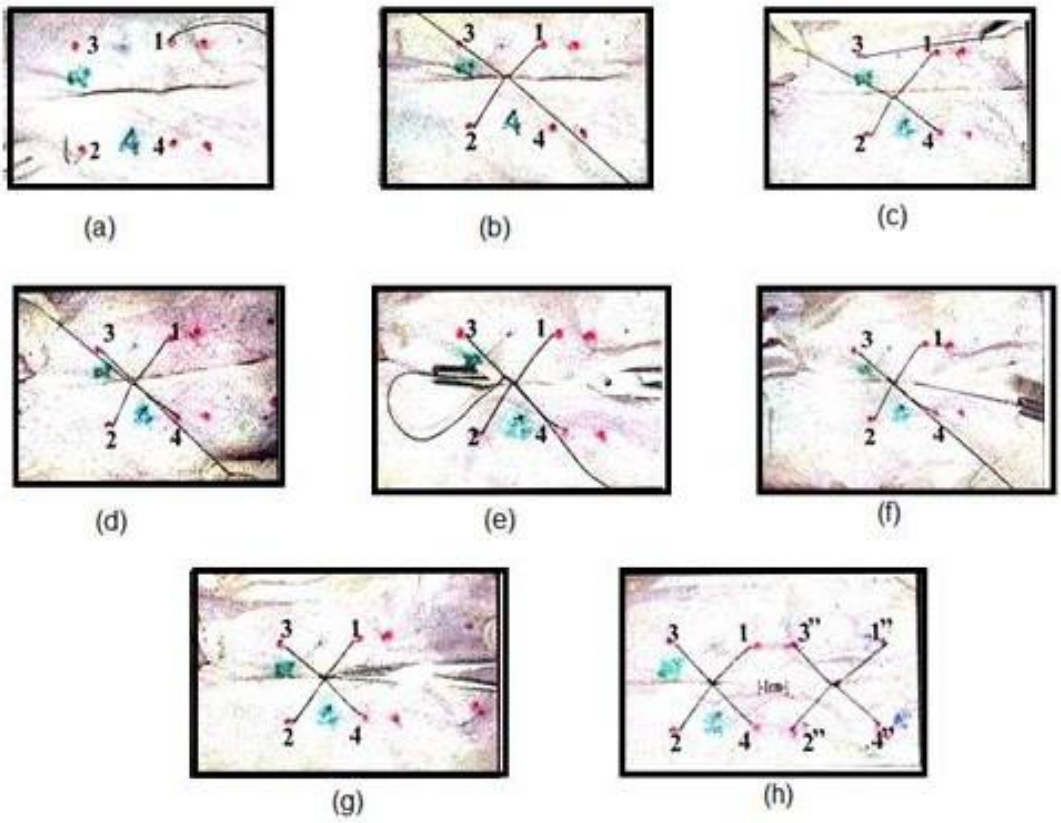
Continuous Closure:

It was performed using No. 1 Prolene suture (polypropylene), care being taken to place each bite 1-1.5 cm from the cut edge of linea alba and successive bites being taken 1cm away from each other. The edges of linea alba were gently approximated without strangulation with an attempt to keep a suture to wound length ratio of 4:1.



Interrupted Double-X Closure:

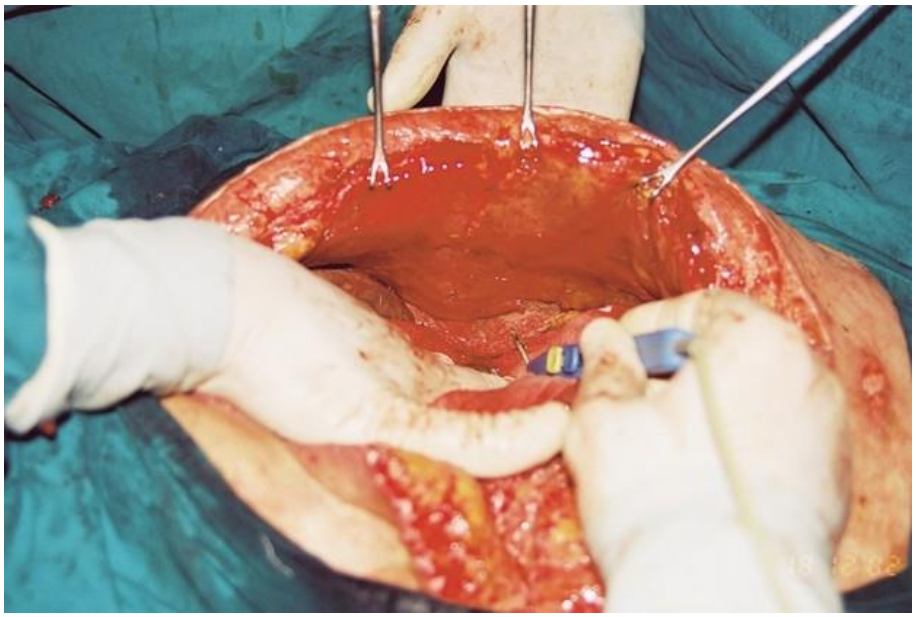
It was performed using No. 1 Prolene suture (polypropylene). A large bite was taken on the cut edge of linea alba at point (1) from outside-in, 2 cm from edge. The needle emerged on the other side from point (2) inside-out diagonally 2 cm from the edge and 4 cm above or below the first bite. This strand was crossed or looped around the free end of suture and continued outside-in, at point (3) and comes at point (4), diagonally at 90 degree to the first diagonal. The two ends were tied just tight enough to approximate the edges of linea alba, taking care not to include bowel or greater omentum between the edges. The small free end of the suture is passed deep to the X behind linea alba and again tied to the other end of the suture. This method of tying four throws in front and four throws behind the X created two X-like crosses - one on the surface and another deep to linea alba. The central knot allowed fixation of four arms of the X like a pivot. The next X-suture was placed 1 cm away (above or below) from the previous one. Thus, in a 14cm long wound, 3 X-sutures were applied (Fig. 2). The suture line was then palpated for any gap with the index finger. Any large gap permitting a finger was closed with a simple interrupted suture.



TI, TIE AND TIES INCISIONS

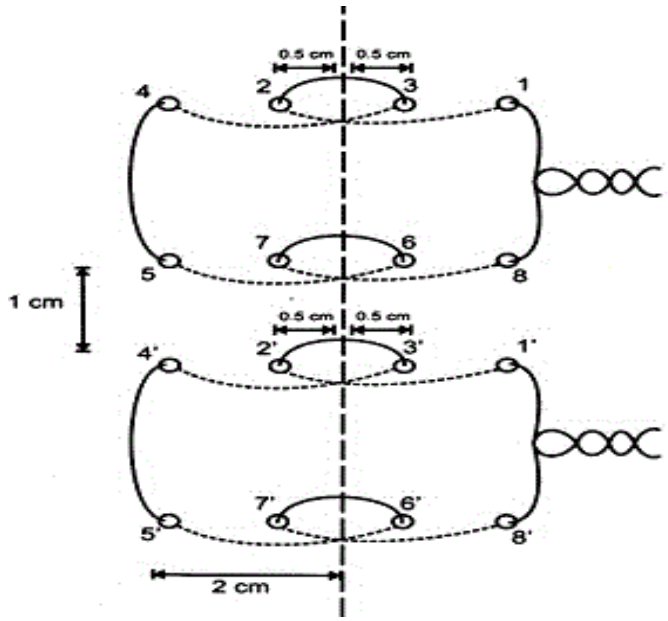
A graduated ruler is placed across the dehiscence between the wound edges, centred by the silk thread to calculate the total deficit, the right deficit (to the right side of the thread) and the left deficit (to the left side of the thread). A longitudinal incision is made using a unipolar diathermy along the area between the mid axillary and anterior axillary line from inside the abdominal cavity starting at costal margin above to the iliac crest below. It was found that incising the transverses abdominus muscle together with the internal oblique muscle (TI incision) along such line will give a 1.5- to 2-cm length towards midline on each side (if needed) without tension. Incising the external oblique layer in addition

(TIE incision), stopping directly at the Scarpa's fascia, gives an extra 1–1.5 cm. Incising the Scarpa's fascia in addition, stopping directly under the skin and subcutaneous adipose layer (TIES incision), gives an extra 0.5–1 cm, with no tension on the midline wound. So incising the different layers—TI, TIE, TIES—on one side gives an additional 1.5–2 cm, 2.5–3.5 cm or 3–4.5 cm, respectively. Incising both sides gives double such lengths, i.e., 3–4 cm, 5–7 cm or 6–9 cm, without any tension. Precalculation of the total, right and left deficit would allows fashioning the necessary incisions needed on each side to allow closure of the dehiscence



Prof. Hughes Far-and-Near Interrupted Method:

The patients in the third arm were treated by Professor Hughes modification of Smead-Jones far-and-near stitch . This comprised a far bite starting at point (1) 2cm on the edge of linea from outside-in and then taking a near bite of 0.5cm at point (2) on the other side inside-out a near bite on the same side outside-in at point (3) and then a far bite on the other side inside-out at point (4). The suture was next converted to a horizontal mattress by taking a far bite 1 cm above or below the previous bite on the other side at point (5) outside-in near bite on the same side at point (6) inside-out, near bite on the other side at point (7) outside-in, and finally a far bite on the same side at point (8) inside-out. The two ends of the suture were tied to approximate the edges of the linea alba.



METHODOLOGY

MATERIALS AND METHODS:

100 patients undergoing midline laparotomy within the inclusion criteria in General Surgery Department Of Govt Rajaji Hospital for a period of 1 year where included in our study after getting proper written informed consent. This patients was followed for 2 week period and were divided into two categories and followed up and findings were collected. A central randomization was performed. The randomization sequence was based on a computer-generated list.

In the control group, the fascia is closed in a continuous manner using continuous 1 prolene located 1 cm from the edge of the linea alba with 1-cm intervals. The continuous suture was locked intermittently every 5 cm to divide the long continuous suture into multiple smaller sections .Subcutaneous tissue was not sutured, and skin was closed using interrupted suture of 2-0 silk

In the intervention group, the fascia was sutured using the same technique as the control group in addition, to it retention sutures were added using a1 prolene every 10 cm and contained 5 cm of the skin, subcutaneous tissue, rectus muscle, and abdominal fascia (except peritoneum) on each side. The first retention suture was placed 5 cm

above the lower end of the incision and repeated every 10 cm toward the upper part of the incision.

SOURCE OF DATA:

All patients satisfying inclusion criteria admitted in General Surgery Department, Government Rajaji Hospital for a period of 1 year

METHOD OF COLLECTION OF DATA:

All patients undergoing midline laparotomy within the inclusion criteria was followed for 2 week period and were divided into two categories and followed up and findings were collected.

INCLUSION CRITERIA

Patient undergoing midline laparotomy 10-cm surgical incision minimum, and having 2 of the following preoperative risks factors for **WOUND DEHISCENCE**

1. Poor nutritional status (clinical cachexia or hypoalbuminemia);
2. Intra-abdominal infection;
3. Uncured extensive-stage malignancy;
4. Use of corticosteroids in the last 12 mo (>10 mg/d prednisolone or equivalent for 3 mo);
5. Uremia;
6. Hemodynamic instability (bp _90mmhg);
7. Haemoglobin <10 mg/dl (due to perioperative blood loss or anemia);
8. Predicted abdominal distension (due to ascites or prolonged ileus);
9. Chronic pulmonary diseases;
10. Clinical jaundice (total bilirubin >3 mg/dl);
11. Diabetes mellitus;
12. Age >60 y

EXCLUSION CRITERIA

1. Patients younger than 18 y
2. incision length of <10 cm

DATA ANALYSIS

Using statistical analysis(chi-square test and paired t test)

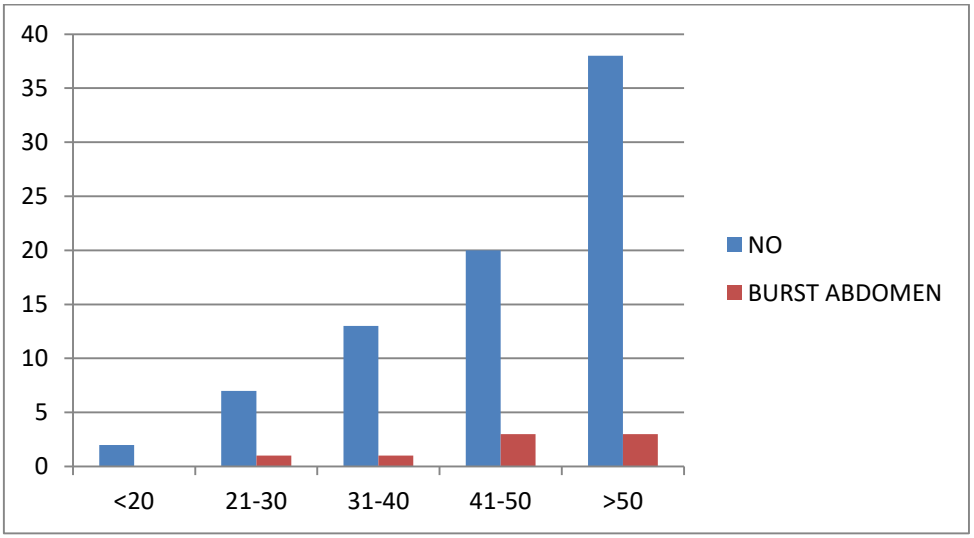
OBSERVATION AND RESULTS

AGE DISTRIBUTION:

In my study most of the patients fall under the age group of more than 50 years, and the incidence of wound dehiscence is common in the age group of 41- 50 years followed by >50 years .this shows as the age increase the chance of wound dehiscence also increases.

The table below shows the age distribution and occurrence of wound dehiscence in corresponding ages

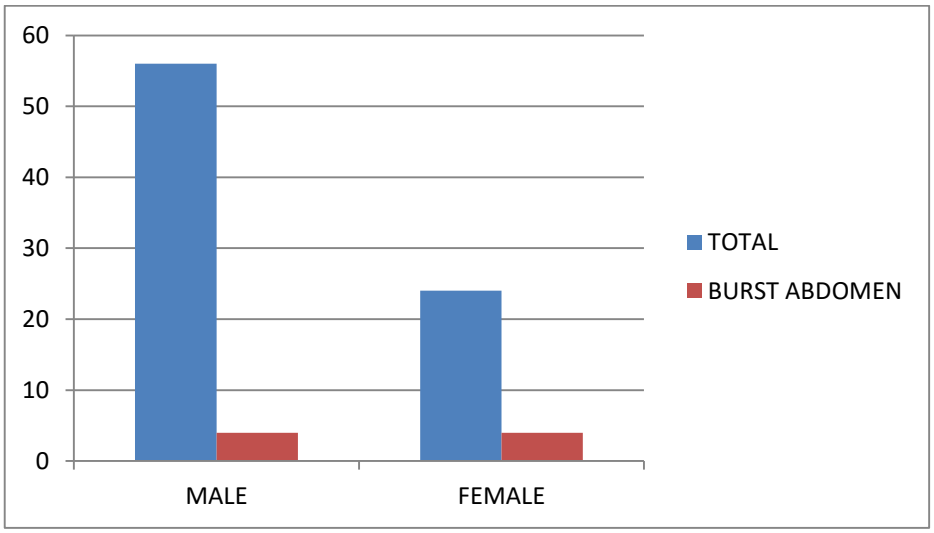
AGE	NO OF CASES	WOUND DEHISCENCE
<20	2	
21-30	7	1
31-40	13	1
41-50	20	3
>50	38	3



SEX DISTRIBUTION:

Among the 80 patients involved in the study 56 patients were male patients and 24 were female patients. Among them 4 male patients and 4 female patients developed wound dehiscence .this shows slightly increased incidence of wound dehiscence in female patients

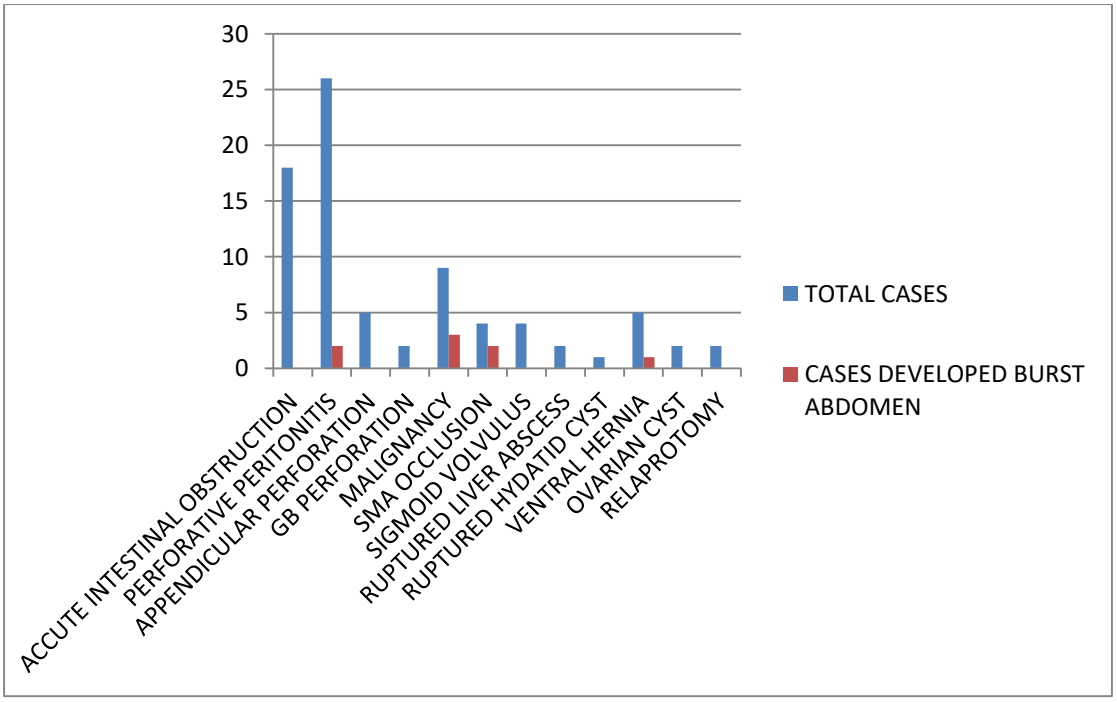
SEX	TOTAL	WOUND DEHISCENCE
MALE	56	4
FEMALE	24	4



CAUSE DISTRIBUTION:

Among the causes for laprotomomy perforative peritonitis was the most common cause (27.5%) followedby acute intestinal obstruction(22.5%) followed by malignancy (11.5%).among this wound dehiscence was more common in vascular diseases(2 out of 4 cases) followed by malignancy(3 out of 9 cases)

The following table shows the disease distribution and wound dehiscence incidence in those diseases.

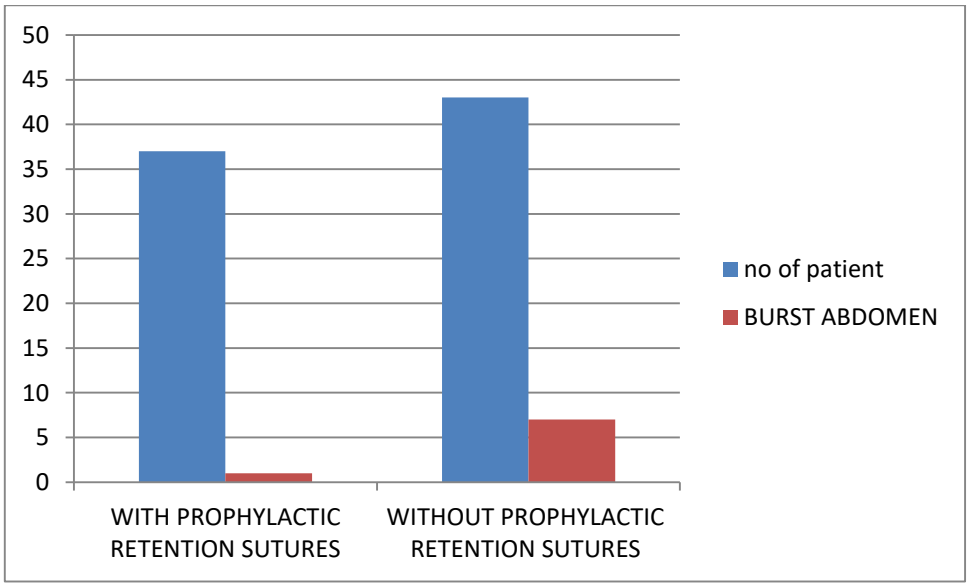


	TOTAL CASES	CASES DEVELOPED WOUND DEHISCENCE
ACCUTE INTESTINAL OBSTRUCTION	18	
PERFORATIVE PERITONITIS	26	2
APPENDICULAR PERFORATION	5	
GB PERFORATION	2	
MALIGNANCY	9	3
SMA OCCLUSION	4	2
SIGMOID VOLVULUS	4	
RUPTURED LIVER ABSCESS	2	
RUPTURED HYDATID CYST	1	
VENTRAL HERNIA	5	1
OVARIAN CYST	2	
RELAPROTOMY	2	

WOUND DEHISCENCE :

Among the 80 patients in our study prophylactic retention sutures were applied for 37 patients and 53 patients were taken as control. Among the 37 patients only one patient developed post operative wound dehiscence comparing to the control group in which among the 53 patients 8patients developed post operative wound dehiscence ,**with a significant p value(<0.001).**

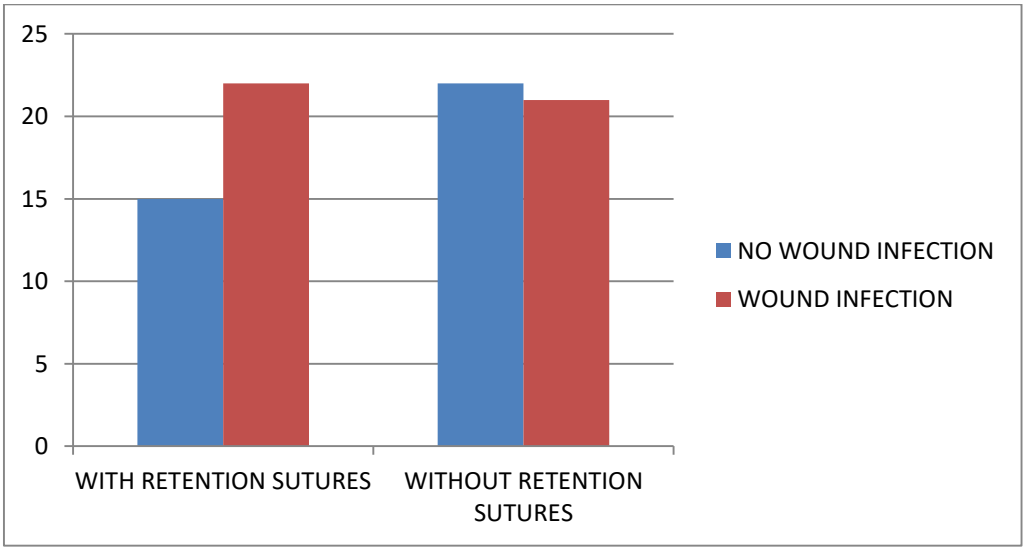
	NO OF PATIENTS	WOUND DEHISCENCE
WITH PROPHYLACTIC RETENTION SUTURES	37	1
WITHOUT PROPHYLACTIC RETENTION SUTURES	43	7



WOUND INFECTION:

Among the 80 patients 41 patients developed wound infections which was treated appropriately, among the patients with prophylactic retention sutures 22 patients out of 37 developed wound infection in comparison with those without prophylactic sutures 21 patients out of 43 developed wound **infection without a significant p value(p value 0.342)**

PROPHYLACTIC RETENTION SUTURES	WOUND_INFECTION		Total	p value	Odds Ratio (95% CI)
	YES	NO			
YES	22 (59.45%)	15 (40.54%)	37 (100%)	0.342	1.54 (0.63-3.73)
NO	21 (48.83%)	22 (51.16%)	43 (100%)		
Total	43 (53.75%)	37 (46.25%)	80 (100%)		



PAIN ASSESSMENT:

Among the patients with prophylactic retention sutures the mean pain score on day 1 was 7.08 when compared to the mean score of without prophylactic sutures being 7.21 without significant **p value(p value-0.414).**Mean pain score on day3 for patients with prophylactic retention sutures were 4.95 when cared to that without prophylactic retention sutures being 4.84 **without significant p value(p value-0.463)**

But when comparing the pain score on **POD 5** the mean pain score for those with prophylactic retention sutures was 3.19 compared to those without retention sutures being 2.67 **with a significant p –value(p value-<0.001)**

Again when comparing the pain score on **POD 7** the mean pain score for those with prophylactic retention sutures was 1.68 compared to those without retention sutures being 1.19 with a **significant p value (p value-<0.001)**

	PROPHYLACTIC RETENTION SUTURES	N	MEAN	STD. DEVIATION	p VALUE BY 't' TEST
PAIN SCORE DAY 1	YES	37	7.08	0.76	0.414
	NO	43	7.21	0.64	
PAIN SCORE DAY 3	YES	37	4.95	0.66	0.463
	NO	43	4.84	0.65	
PAIN SCORE DAY 5	YES	37	3.19	0.57	< 0.001
	NO	43	2.67	0.57	
PAIN SCORE DAY 7	YES	37	1.68	0.53	< 0.001
	NO	43	1.19	0.45	

SUMMARY

WOUND DEHISCENCE is a devastating incident that can cause pain, mental distress, infectious complications, and financial burdens for the patient, as well as complications including evisceration and reoperation. Surgeon expertise, type of incision, suturing material, surgical site infection, nutritional status, persistent cough, abdominal distension, leakage of pancreatic enzyme, anaemia, obesity, diabetes, jaundice, old age, emergent operation, particular procedures such as colon surgery, and late wound healing due to malignancy have all been suggested to predispose patients to abdominal wound dehiscence.

Some of these factors are unavoidable .To lower the incidence of abdominal wound dehiscence, it has been recommended to improve patient nutritional status, prevent possible infection of surgical sites by administration of prophylactic antibiotics, restrict plasma glucose in diabetic patients, provide efficient oxygenation, maintain hemodynamic stability and sufficient tissue perfusion, control hypothermia, apply proper surgical techniques, and reduce tissue tension.

Different surgical techniques for closing the wound should be carefully considered. Suture materials are of great importance in providing sufficient strength and influencing adverse events . Some authors have

proposed the application of thick or retention sutures as a preventive strategy to eliminate or reduce the occurrence of wound dehiscence.

Retention sutures have already been shown to reduce the rate of wound dehiscence after surgery, and their use has also been suggested as a treatment choice for managing fascial dehiscence , however, due to the subsequent pain, postoperative discomfort, and skin maceration, routine application of this technique has not been well accepted. Considering the controversies involved in using this method for the prevention of abdominal wound dehiscence, **my study included only patients at a high risk for developing wound dehiscence who would benefit the most from prophylactic retention sutures.**

CONCLUSION

When risk factors of wound dehiscence are in opposition to the complications of retention sutures, surgeons should determine which condition is more serious. Complications such as intestinal damage, skin maceration and cutting lesions, surgical site infections, and patient pain or discomfort prohibit the surgeons from performing this technique. However, in the presence of a high possibility for developing wound dehiscence due to the accompanying conditions, the benefits of retention sutures may outweigh the disadvantages and the technique should be considered

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PROFORMA

Name	:	I.P. No	:
Age	:	Unit	:
Sex	:	D.O.A	:
Occupation	:	D.O.D	:
Address	:		
Phone No	:	D.O. Surgery	

CHIEF COMPLAINTS

PAST HISTORY:-

1) History of similar complaints
2) Treatment taken
3) History of Drug intake
4) History suggestive of Hypertension / Diabetes / Tuberculosis / heart disease / jaundice / thyroid disorder.

PERSONAL HISTORY:-

Diet : Vegetarian / Mixed

Habits : Smoking / Alcohol / Tobacco

Bowel habits

Bladder

Sleep

FAMILY HISTORY:-

Relevant / Not

MENSTRUAL HISTORY:-

Amenorrhoea / menorrhagia

Regular / Not

Duration

Associated / Not with pain

L.M.P.

GENERAL PHYSICAL EXAMINATION : -

1. General survey
2. Body build and nourishment
3. Appearance
4. Attitude : Restless / Quiet
5. Dehydration : Mild/ Moderate / Severe / Nil
6. Anaemia / Jaundice / Clubbing Cyanosis / Lymphadenopathy / Pedal oedema.
7. Eye signs
8. Skin Changes
9. Pulse
10. Temperature
11. Respiratory rate
12. Blood pressure

SYSTEMIC EXAMINATION

- Cardiovascular system
- Respiratory System
- Central nervous system
- Genito - urinary system
- Abdomen
- Oral cavity

INVESTIGATIONS:-

1. Hb%
2. TLC
3. DLC
4. BT
5. CT
6. ESR
7. Blood group and Rh type.
8. Urine : Albumin / Sugar / Microscopy
9. Blood : sugar / Urea / creatinine
10. ECG
11. USG abdomen and pelvis
12. CECT Abdomen/pelvis
13. HPE

14.HIV

15.HbsAg

16.Others

DIAGNOSIS

MANAGEMENT

SURGICAL

Pre operative instructions

Type of Anaesthesia

Post - operative instructions

Post - operative period/Post - operative complication management

SL.NO	NAME	AGE/SEX	IP NO	DIAGNOSIS	PROCEDURE	COMORBIDITY	PROPHYLACTIC RETENTION SUTURES	POST OP BURST ABDOMEN	PAIN SCORE ON DAY 1	PAIN SCORE ON DAY 3	PAIN SCORE ON DAY 5	PAIN SCORE ON DAY 7	WOUND INFECTION
1	bhadur nisha	52/F	59148	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	YES	NO	7	5	3	2	YES
2	RAVI KUMAR	19/M	58999	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	8	5	2	1	YES
3	RAKIMA BEEVI	23/F	5127	ACCUTE INTESTINAL OBSTRU	RESECTION ANA	YES	NO	NO	7	4	3	1	NO
4	VELLASAMY	41/M	58260	PERFORATION PERTONITIS	OMENTAL PATC	YES	YES	NO	8	6	3	2	YES
5	CHELLAPANDI	30/M	57729	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	8	5	2	1	NO
6	PAPPU	63/F	56935	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	YES	NO	6	4	4	2	YES
7	PALANIMUTHU	33/M	56962	APPENDICULAR PERFORATIO	APPENDICECTOI	YES	YES	NO	7	5	3	2	YES
8	KARUPPU	49/M	56678	CA OESOPHAGUS	TRANS HIATAL C	YES	NO	YES	7	4	3	1	NO
9	MURUGAN	75/M	56653	PERFORATION PERTONITIS	OMENTAL PATC	YES	YES	NO	8	6	2	1	NO
10	AROKIA FELSIA	24/F	54066	GB PERFORATION	LAPROTOMY AN	YES	NO	YES	6	5	4	1	NO
11	KUMARESAN	48/M	55457	ILEO CAECAL GROWTH	RIGHT HAEMICO	YES	YES	NO	6	4	3	2	YES
12	SAYED ALIBABA	41/M	55033	SMA OCCLUSIO	ILEOSTOMY	YES	NO	NO	7	5	3	1	NO
13	MUTHURASU	28/M	54923	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	4	3	1	YES
14	RAJALAKSHMI	48/F	54705	TRANSVERSE COLON TEAR	PRIMARY REPAI	YES	NO	NO	8	5	3	1	NO
15	VIJAYA	46/F	51719	CYSTIC NEOPLASM OF PANCR	LAPROTOMY AN	YES	NO	NO	7	5	2	1	YES
16	SAJAHAN	60/M	54026	SIGMOID VOLVULUS	HARTMANS PRO	YES	YES	NO	8	5	4	3	YES
17	SARAVANAMALAI	61/M	4797	PERFORATION PERTONITIS	OMENTAL PATC	YES	YES	NO	7	6	3	2	NO
18	THARMARAJ	57/M	53357	ACCUTE INTESTINAL OBSTRU	ENTEROTOMY	YES	NO	NO	7	5	3	1	NO
19	PAULRAJ	54/M	53761	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	4	2	1	NO
20	RATHINAMALA	43/F	52752	ILEO CAECAL GROWTH	ILEOTRANSVERS	YES	YES	NO	8	5	4	2	YES
21	RAJA	48/M	52047	RUPTURED LIVER ABSCESS	LAPROTOMY AN	YES	YES	NO	7	5	3	2	YES
22	ARISUPANDI	42/M	52649	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	4	3	1	NO
23	CHOKKAMAL	62/F	52392	UMBLICAL HERNIA WITH ILEA	RESECTION ANA	YES	YES	NO	8	5	3	2	NO
24	GANESAN	63/M	52391	APPENDICULAR PERFORATIO	APPENDICECTOI	YES	NO	NO	7	5	2	1	YES
25	PANDI	39/M	52183	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	6	4	3	1	NO
26	NAGU	70/M	51888	RUPTURED HYDATID CYST	LAPROTOMY AN	YES	NO	NO	7	5	2	1	NO
27	LAKSHMI	40/F	51334	OVARIAN CYST WITH ADHESI	OPHERECTOMY	YES	YES	NO	6	5	3	2	YES
28	CHINA GURUSAMY	70/M	52989	ACCUTE INTESTINAL OBSTRU	RESECTION ANA	YES	YES	NO	7	4	2	2	YES
29	AHMAD KABIR	63/M	50868	APPENDICULAR PERFORATIO	APPENDICECTOI	YES	NO	NO	8	6	3	2	YES
30	ADHILAKSHMI	64/F	49812	OBSTRUCTED VENTRAL HERN	RESECTION ANA	YES	NO	NO	8	5	2	1	NO
31	BALU	60/m	49913	PERFORATION PERTONITIS	OMENTAL PATC	YES	YES	NO	7	6	3	1	NO
32	MANOHARAN	58/M	36099	ACCUTE INTESTINAL OBSTRU	COLOSTOMY	YES	NO	NO	8	5	4	1	NO
33	PERIYAPANDI	60/M	32067	ILEAL GANGRENE	RESECTION ANA	YES	NO	YES	8	4	3	2	YES
34	TAMILMUTHU	52/M	32501	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	5	3	1	NO
35	MATCHAKALAI	63/M	31261	ACCUTE INTESTINAL OBSTRU	HARTMANS PRO	YES	YES	NO	7	5	3	1	YES
36	NARASALINGAM	45/M	20847	ILEAL GANGRENE	ILEOSTOMY	YES	NO	YES	6	4	3	2	YES
37	AROCKIAM	67/M	26898	JEJUNAL ADENOCARCINOMA	RESECTION ANA	YES	YES	NO	7	4	4	1	NO
38	CHINNAKARUPAN	57/M	31130	PERFORATION PERTONITIS	GASTRECTOMY	YES	YES	NO	8	5	3	2	NO
39	VEERAMAL	56/F	19625	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	NO	NO	7	5	2	1	YES
40	MOOKALAGAN	36/M	13456	ACCUTE INTESTINAL OBSTRU	ILEOSTOMY	YES	NO	NO	7	5	2	1	NO
41	RITHIGAN	18/M	17271	GASTRIC PERFORATION WITH	GASTRECTOMY	YES	YES	NO	6	4	3	1	NO
42	GOMATHI	48/F	17565	GB PERFORATION	SUBTOTAL CHOI	YES	NO	NO	8	6	3	1	YES
43	PASUPATHY	70/M	16851	ACCUTE INTESTINAL OBSTRU	COLOSTOMY	YES	YES	NO	7	5	4	2	YES
44	MUNIYAMMAL	63/F	16110	CA CAECUM	RIGHT HAEMICO	YES	NO	YES	8	5	2	2	YES
45	PARVATHY	48/M	5471	RECURRENT INCISIONAL HERI	PRIMARY REPAI	YES	NO	YES	7	4	3	2	YES
46	RAVICHANDRAN	49/M	12950	PERFORATION PERTONITIS	OMENTAL PATC	YES	YES	NO	8	5	4	2	YES
47	PETCHIRAJ	32/M	10197	POST SPLEENECTOMY TRANC	RESECTION ANA	YES	NO	NO	8	5	3	1	NO
48	CHINNASAMY	22/M	49474	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	6	3	1	NO
49	SOMAGIRI	65/F	48736	ACCUTE INTESTINAL OBSTRU	RESECTION ANA	YES	YES	NO	8	5	3	1	NO
50	KALIIAPPAN	40/M	48656	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	5	2	1	NO

51	MUTHU	60/M	48519	APPENDICULAR PERFORATIO	APPENDICECTOI	YES	YES	NO	6	4	3	1	NO
52	PANDISELVI	45/F	25263	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	NO	NO	6	5	2	1	NO
53	PERYASAMI	72/M	3973	UMBLICAL HERNIA WITH ILEA	RESECTION ANA	YES	YES	NO	7	6	3	1	YES
54	MURUGESAN	39/M	48118	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	8	5	2	1	YES
55	PONNIAH	65/M	48023	SMA OCCLUSIO	RESECTION ANA	YES	YES	NO	7	5	3	2	NO
56	SELVARAJ	47/M	49030	RUPTURED LIVER ABSCESS	LAPROTOMY AN	YES	NO	NO	7	4	3	3	YES
57	ABDHULLAH	25/M	47463	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	6	4	3	1	NO
58	PANDIYAMMAL	64/F	49310	SIGMOID COLON GROWTH	SIGMOID COLEC	YES	YES	YES	7	5	2	1	YES
59	RAJA	40/M	47177	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	4	3	1	YES
60	MANGALAM	45/F	41551	POST OP ANATAMOTIC LEAK	COLOSTOMY	YES	YES	NO	7	5	3	2	NO
61	ARUNKUMAR	30/M	46311	OBSTRUCTED VENTRAL HERN	PRIMARY REPAI	YES	NO	NO	7	5	2	1	YES
62	CHINNAKARUPAN	28/M	45634	APPENDICULAR PERFORATIO	APPENDICECTOI	YES	NO	NO	7	5	2	1	NO
63	KARUTHUPANDI	41/M	45617	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	7	4	3	1	YES
64	INDIRANI	69/F	45505	ILEALCAECAL GROWTH	RESECTION ANA	YES	YES	NO	6	4	3	1	YES
65	RAJAMANI	45/F	39564	POST HYSTERECECTOMY PELV	LAPROTOMY AN	YES	YES	NO	8	5	3	2	YES
66	PANCHAVARNAM	40/F	15431	PERFORATION PERTONITIS	GASTRECTOMY	YES	NO	YES	7	5	3	2	YES
67	MUNIYANDI	50/M	44294	ACCUTE INTESTINAL OBSTRU	RESECTION ANA	YES	YES	NO	6	5	3	2	NO
68	MURUGESAN	35/M	44294	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	YES	NO	6	4	4	1	YES
69	BOOMINATHAN	54/M	42755	ACCUTE INTESTINAL OBSTRU	RESECTION ANA	YESN	YES	NO	7	5	4	1	YES
70	CHANDRAN	60/M	43806	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	NO	NO	7	5	3	1	YES
71	RAMIAH	70/M	41365	SIGMOID VOLVULUS	HARTMANS PRO	YES	YES	NO	8	6	3	2	NO
72	GANDHI	55/M	43213	ILEAL PERFORATION	PRIMARY REPAI	YES	NO	NO	7	5	3	1	YES
73	MANTHAKALAI	54/M	28714	SIGMOID VOLVULUS	HARTMANS PRO	YES	YES	NO	7	6	4	2	YES
74	MOOKAM	53/M	42616	SIGMOID VOLVULUS	HARTMANS PRO	YES	NO	NO	8	6	3	1	NO
75	SELVI	40/F	41520	OVARIAN TUMOUR WITH AS	LAPROTOMY AN	YES	YES	NO	7	5	3	2	YES
76	PITHCAIAMMAL	55/F	29261	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	YES	NO	8	5	4	1	NO
77	GURUSAMY	70/M	39807	ILEAL GANGRENE	RESECTION ANA	YES	YES	NO	8	5	3	2	NO
78	DEIVANAI	65/F`	39777	PERFORATION PERTONITIS	OMENTAL PATC	YES	NO	NO	8	6	3	1	YES
79	THILAGARANI	45/F	38465	ACCUTE INTESTINAL OBSTRU	BAND RELEASE	YES	YES	NO	6	4	3	2	YES
80	VENKATACHALAM	43/M	39618	PERFORATION PERTONITIS	OMENTAL PATC	YESS	NO	NO	8	6	2	1	YES

MADURAI MEDICAL COLLEGE
MADURAI, TAMILNADU, INDIA -625 020
(Affiliated to The Tamilnadu Dr.MGR Medical University, Chennai, Tamil Nadu)

ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr.Ram Praveen P
Course	:	PG in MS., General Surgery
Period of Study	:	2016-2019
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Prospective study of Effect of prophylactic retention sutures in midline Laparotomy in High-Risk patients for prevention of wound dehiscence
Ethical Committee as on	:	21.11.2017

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary | Chairman | Dean / Convenor

Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc (Hon)
CHAIRMAN
IEC - Madurai Medical College
Madurai

DEAN
Madurai Medical College
Madurai-20

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CERTIFICATE – II

This is to certify that this dissertation work titled **"PROSPECTIVE STUDY OF EFFECT OF PROPHYLACTIC RETENTION SUTURES IN MIDLINE LAPAROTOMY IN HIGH-RISK PATIENTS FOR PREVENTION OF WOUND DEHISCENCE IN GOVERNMENT RAJAJI HOSPITAL, MADURAI"** of the candidate **Dr. RAM PRAVEEN .P** with Registration Number 221611120 for the award of MASTER DEGREE in the branch of GENERAL SURGERY. I have personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows 15% of plagiarism in the dissertation.

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